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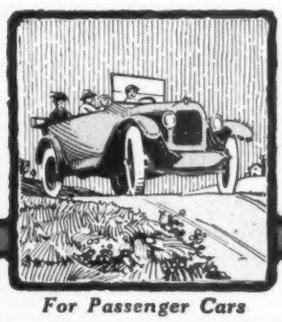
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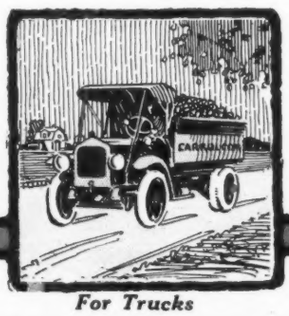
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AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

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Complete Inspection Procedure for Airplane Engines

Inspection Work in Engine Factories Falls Into Four Divisions—A List of Things to Be Checked Under Each Heading

By Lieut. P. J. Piccirilli*

AIRPLANE engine inspection may be conveniently divided under four headings, as follows:

1—Parts Inspection
2—Assembly Inspection
3—Inspection on Test
4—Overhaul Inspection

In parts inspection each individual part is inspected separately. Under the name of each part is given a list of important dimensions and other features to be checked up. An inspection of any part under this heading should show whether its further consideration in the assembly is warranted.

It will be noticed that in the parts inspection in a good many cases a number of considerations are omitted to allow for a complete detail inspection. This is based on the writer's experience with airplane engines.

It was very often found that in carrying out a complete detailed inspection on parts, a great many times such parts would fail to pass. On the other hand, in assembling on the engine the same parts which were otherwise rejected would bear the proper relationship with other parts. Therefore, in most cases, to carry out a complete detail inspection on the individual parts, such as camshafts, crankshafts, gears, etc., might give rise to excessive rejection of such parts which, when assembled, would prove serviceable.

For this reason, the writer has included all these details under the second heading and discussed them in connection with the assembly. The advantage of this method of procedure from the points of view of production and salvage is evident. No comment is called for by headings 3 and 4.

I—Parts Inspection—Camshaft

1—A general survey by sounding the entire case is very advisable. This will give an idea as to the grade of casting as a whole and indicate the existence of cracks or welds.

2—Make a careful scrutiny of the inside of the case and note the degree of porosity, especially in the various webs and bosses, paying particular attention to the presence of welds, checks or cracks. The main bearings and bosses should be examined very closely, as very often they are split when studs are set in.

3—Examine gear case for cracks or welds where the magneto base fastens on. See that hole for magneto drive is not bored oversize. Try all tap holes in gear case face with plug gage for oversize.

4—All camshaft bearings must be machined according to drawings. Pay particular attention to the stock under the front camshaft bearing, as the greatest stress due to whipping and vibration occurs at this point (propeller end). Carefully observe the holes drilled for camshaft retaining screws and see that they are not oversize or plugged.

5—Examine deck of upper half of crankcase and, in the case of V type motors, closely watch apex, noting possible cracks, checks or degree of porosity, welds, etc. Note carefully the amount of stock at breather pipe studs and make sure that it is sufficient. Insufficient stock at this point might cause a weakening of surrounding material where studs are set in place. Above all, note that the decks are of equal thickness.

The case should be properly faced for cam follower guides. Cam follower guide holes and cylinder holes should be chamfered. This is to allow these assembled parts to lie flush. Removing all feather edges will also improve resistance of material at the above points.

Allow no defective metal, plugs or welds in the walls between the cylinder decks and the case flanges; also be sure that all engine tie-down lugs are of substantial material, not tolerating defective material of any de-

Lieut. P. J. Piccirilli supervised the construction of several hundred Curtiss airplane engines at the Hammondsport plant.

scription, as all stresses due to thrust are transferred through these parts.

See that the case flange is of the proper thickness to give sufficient strength.

6—See that all main bearing shells are tight in place in the bore all around, and flush with the top of the case, being sure to observe that they do not come below the case level, so as to provide a proper fit when the cap is put in place. Otherwise you may have a loose main bearing shell.

Be sure to have all main bearing studs tight in the lugs, and see that the lugs were not cracked when the studs were put in place.

Screws in the main bearings holding the bearing to the case should not be too near the surface of the bearing metal, and the babbitt should be countersunk.

7—In the main bearing caps note the condition of the babbitt and allow no cracks, checks or excessive porosity.

Note possible cracks at stud holes. Cracks in main bearing caps are apt to occur at this point. Very often main bearing caps are injured by turning down the nuts without the washers or plates being in.

8—All case clamping studs want to be tight in the case and of proper height. Note the condition of the threads.

9—See that the gear case face is machined to allow the proper clearance between the gear case cover and the half-time (magneto) gear. Also observe that the screw bosses allow the proper clearance for the magneto gear.

10—Lower half of crankcase should be carefully scrutinized and the degree of porosity noted. Look for cracks, welds or defective material, especially at corners.

In conclusion, see that both upper and lower halves are scraped clean and all sand or dirt is removed.

Camshafts

1—Check over all measurements of intake cams.
2—Take measurement of rear bearing.
3—Take measurement of front bearing.
4—Take measurement of gear bearing.
5—Size of all front bearings and gear bearings (micrometer).
6—Scleroscope test of cams and bearings.
7—General inspection as to physical properties.

Cam Follower Assemblies

1—Inspection for alignment of cam followers in guide.
2—Scleroscope test.
3—General inspection as to physical properties of cam followers and guides.

Camshaft Gears

1—Sizing of bored or reamed hole.
2—Inspection in gear center fixture to insure free running.
3—Inspection as to physical properties and finish.

Carbureters (Assembly)

This includes a general inspection of the assembly work as follows:

1—Inspection of the throttle valve as to fit and alignment.
2—Inspection of the throttle valve lever.
3—Inspection of the hot air valve and lever.
4—Inspection of the wiring of screws.
5—Inspection of body, noting degree of porosity.
6—Checking up settings.
7—See that slow speed adjustment is not plugged.

Crankshafts

1—Length over all from thrust bearing cap to half-time gear.
2—Height and width of propeller hub key.
3—Micrometer dimensions of each bearing and crank pin.
4—Inspection as to checks in main bearings and crank pins.
5—General inspection of half-time gear and oil drive gear.

Cylinders (Assembly)

1—Length of rocker arm support and manifold studs.
2—Dismantling of valves to get size of valve stem guides, condition of valves and valve seats in cylinders, testing of valve springs for pressure.
3—Size of bore for out-of-roundness and taper.
4—Height from rocker arm support seat to tie-down flanges.
5—General inspection of jackets for porosity.
6—Test with thread gage of spark plug hole and inlet water nipple.
7—Water test, 80 lb. per sq. in.

Intake "Y" Assembly

1—Inspection of all studs for length and condition of threads.
2—General inspection for porosity and condition of finish of inner and outer surfaces.
3—Inspection for cracks around stud bosses and water test.
4—Water test, 80 lb. per sq. in.

Intake Manifolds

1—Length of stud bosses.
2—Gaging manifold coupling stud hole threads.
3—Inspection of inner and outer surfaces.
4—General inspection for porosity.
5—Alignment of part flanges.
6—Water test, 80 lb. per sq. in.

Intake Manifold Coupling

1—Inspection of inner and outer surface.
2—General inspection for porosity.
3—Water test, 80 lb. per sq. in.

Oil Pump Assembly

1—Gaging master gear shaft which drives oil-drive pinion.
2—Clearance of gears and running condition of same.

Oil Drive Assembly

1—Gaging master gear fit in pinion.
2—Gaging pinion fit in bracket.
3—Checking trueness of bore in bracket to facing of pinion.

Piston and Connecting-Rod Assemblies

1—Weighing within limits of $\frac{1}{8}$ oz. total variation.
2—Testing of frictional resistance of piston pins in piston.
3—Checking skirt for size and distortion with micrometers.

Pistons

1—Getting side clearance of piston rings with feeler gage.
2—Condition of piston pin bearing after being rolled in.
3—General inspection for cracks and porosity.
4—O. D. of top and bottom of piston.
5—Depth and width of ring grooves.

Connecting-Rods

1—Gaging size of bearings with plug gage.
2—See that rods are of proper hardness as may be indicated by scleroscope or Brinnel tests.

3—Note length of bolt lugs.
4—General inspection as to porosity, bolts, nuts and bore of bearing.

Propeller Hub Assembly

1—Testing with plug gages to determine proper taper and size.
2—Inspection of fit of nuts, radius of bolt heads, cotter pin holes, fit of propeller hub lock nut and tension of propeller hub nut lock spring.
3—Inspection of keyway with gage to see that key is central.

Piston Pins

1—Scleroscope test.
2—Location of lock screw holes.
3—General inspection of outer and inner surface.
4—Check up outside diameter for size.

Piston Rings

1—Check width with micrometer.
2—General inspection of physical properties.

Valve Action Assemblies

1—Inspection of clearance between rocker arms and yokes.
2—Fit of push rod threads in yokes.
3—Distortion of push rods.
4—File test of tappets for hardness.
5—General inspection for cracks and assembly workmanship, note degree of porosity and watch out for soft solder spots.

Thrust Bearing

1—General running condition.
2—Obtain width and outside diameter of bearing.

Water Pump

1—Note end thrust of shaft.
2—General inspection for porosity of bodies and assembly workmanship.
3—Inspection on hot water running test for leakage.

Pressure Pumps

1—Inspection of general running condition at 4 to 5 lbs. pressure.
2—Inspection of bodies for porosity and assembly workmanship.

Crankshaft (Balancing)

1—Inspection for static and dynamic balance.
2—Inspection for width and thickness of cheeks.
3—Inspection for fit and finish of oil plugs.
4—Inspection for misalignment of bearings.
5—Gaging propeller hub taper.
6—Gaging thrust bearing lock nut and propeller hub nut threads.
7—Gaging dimensions of propeller hub keyway.
8—Check for trueness.

II—Assembly Inspection

Following is a list showing operations for the complete motor which will be referred to numerically in discussing Assembly Inspection:

1—Tap and stud case.
2—Cut fillets and ream.
3—Fit gear covers and clean case.
4—Fit cam followers and cam shaft.
5—Fit crankshaft and oil drive.
6—Fit connecting rods and breather pipes.
7—Fit cylinders.
8—Fit manifolds and valve actions.
9—Fit magnetos, timing wiring.
10—Fit lower half, gear case covers and magneto cover.
11—Fit intake pipes, water pump and carbureter.

Belting

1—5-hr. limber run. 2—5-hr. official run.

Assembly Inspection Details

OPERATION 1. Studding.

1—All stud holes are to be hand-tapped to size and should be slightly countersunk on the inside of the case.
2—All studs are to be hand-threaded to size and all nickel is to be removed from the case end of same, in case of nickeling.
3—All studs should be tried to see that they are absolutely tight in the case.
4—At this point in the assembly the studs are not to be drilled for cotter pins.
5—Note proper location of name plate.

OPERATION 2. Reaming of main bearings.

1—Examine all main bearings carefully and note degree of porosity or defective babbitt. Be sure that there is sufficient bearing metal for reaming and that it has a good bond with the shell. Also see that the shell fits tight in the case bore.
2—Examine all grooves and oil retainers to see that they are machined to drawing; also that all screw heads are set deep enough to have sufficient clearance after bearings are finished.
3—After main bearings are finish-reamed in the case, try them for alignment by inserting a testing bar 0.001 in. smaller in diameter than the main bearings. Note that the bar can be rotated freely by hand and moves through the bearings without springing.
4—All bearings must be reamed 0.002 in. larger than the crankshaft main bearings, with a 0.0005-in. tolerance under or over. These working limits on the bearings are determined by plug gages. No burnishing or scraping should be tolerated. The main bearings are to be reamed smooth.

OPERATION 3. Case cleaned.

1—Note that fits of gear case cover, magneto drive half covers and thrust clamp are correct.
2—Oil grooves should be cut in thrust clamp and must correspond with those in the lower half.
3—The case should be scraped smooth and all sharp corners removed, and the case should be washed clean with gasoline before proceeding with next operation.

OPERATION 4. Camshaft and cam followers assembled.

1—All cam follower guides are to be properly fitted to the case.
2—Examine cam followers for cracks and checks, and see that they have the proper clearance in the guides and do not bind. See that the case is spot-faced under the retaining screws and that they are tight in the guides.
3—See that the cam bearings fit tight in the case and that the camshaft rotates freely in the bearings. All bearings must be reamed 0.0015 in. larger than the camshaft journal, with a 0.0005-in. tolerance under and over. The shaft must have at least 0.002 in. end-play and not more than 0.006 in. end-play. See that the cam followers follow the cams properly.
4—Examine the front cam bearing carefully for cracks.
5—See that all pilot screw holes are tapped to the correct size and that the under side of the screw heads fits flush with the boss.

OPERATION 5. Fitting of crankshaft and oil drive.

1—Before fitting crankshaft, examine all bearings carefully and see that they are free and clean.
2—Examine crankshaft, seeing that all pins and main bearings are free from checks, cracks or rust and have

all sharp edges removed from checks. Examine gear and see that all teeth are milled uniformly.

3—Burnishing bearings and scraping should not be allowed unless authorized by inspector. See that sides are filed for crankshaft end clearance.

4—Shaft must rotate freely in bearings. A minimum clearance of 0.045 in. is allowed between the cheek and the side of the bearings on the thrust side, and 0.025 in. on the opposite side.

6—After the crankshaft has been inspected and passed, remove the front bearing. Wire up the main bearing castle nuts. Drill and tap the holes and fix the studs for the oil drive pinion brackets.

7—Apply and fit the oil drive pinion bracket to the front bearing.

8—See that the shaft of the gear rotates freely in the bushing.

9—When fitting, try the gears and line them up. Back lash in the gears to be between the limits of 0.003 in. and 0.006 in. Outside diameter of oil drive to be central with shaft within 0.010 in. and bottom set level within 0.0015 in.

10—After it has been inspected and passed, remove bracket and front main bearing cap. Drill and tap threads in front bearing cap and bracket for retaining screws. Replace bearing cap and finally fix bracket.

11—Replace camshaft gear and try back lash, allowing a minimum of 0.003 in. and a maximum of 0.006 in.

OPERATION 6. Fit connecting rods and breather pipes.

1—Assemble breather pipes to case, noting thickness of flange and length of studs.

2—See that holes in studs are drilled correctly for cotter pins to line up with castellation of nuts. Assemble connecting rods and pistons to crankshaft pins. Burnishing of bearings should not be permitted. Examine bearings for porosity and poor bond between shell and babbitt.

3—When assembled, try for fit, seeing that all connecting rods have the necessary clearance between bearings and pin. The clearance here should be 0.0015 in. to 0.002 in.

4—See that all nuts have cotter keys and are pulled up snugly.

OPERATION 7. Fit cylinders.

1—Note the degree of porosity in the top and lower beads and see that the nickel-plating does not peel off, if the rod is nickel plated. Water jackets to be free from bad dents. See that no cracks occur around the studs and bosses of the water outlet seat. All nuts on the bottom flange of the cylinders must have lock washers and be snugly pulled up. Lock washers to be replaced with cotter pins in overhaul.

2—After cylinders have been fitted, inspect for line-up. Intake faces of cylinders are to be in alignment within 0.005 in. Intake manifolds to be in alignment within 0.025 in. Water outlet seats to be in alignment within 0.025 in.

3—Top of valve stems to be in alignment within 0.005 in.

OPERATION 8. Fit manifolds and valve action.

1—Assemble valve actions to motor.

2—Examine rocker arms and try clearance in bearing pins; also look for cracks and machine defects.

3—Turn the camshaft over with special socket wrench to try all valve actions.

OPERATION 9. Magneto timing and wiring.

1—Time motor from No. 1 cylinder and mark gears. Make out timing slip and place it with assembly operation card.

2—Fix name plate.

3—See that all wires are properly insulated. Note conditions of terminals.

OPERATION 10. Fit lower half, gear case covers, magneto covers.

1—Reverse motor on stand and rewash it.

2—Make general inspection to see that all is clean before pouring in oil. Oil must be absolutely clean and of specified grade.

3—Clean lower half of case and splash pans. Assemble lower half to upper half. All nuts on flange to be snugly pulled up.

4—Assemble thrust bearing and clamp. Try clearance between oil slinger and inside radius clamp, which should not be less than 0.010 in. all around. See that all fillister head screws are wired.

5—Fit gear case cover to motor. See that screw holes are not tapped oversize and threads not stripped. Clearance between gear case opening and crankshaft gear journal should be between 0.006 and 0.008 in.

OPERATION 11—Fit intake pipes, water pump, carbureter.

1—Assemble intake water pipe. See that all nuts on cylinder nipple joints are fastened tight. All rubber connections to be tightly fixed to prevent water leakage.

2—Assemble pressure pump and tachometer drive to motor. See that all fixture screws have lock washers and are snugly pulled up.

3—Assemble intake gas pipe, intake "Y" and carbureter, carbureter supports, brace, etc., to motor.

4—Try lever of butterfly throttle for opening and closing and tension of spring. Try lever of air intake. Try slow speed screws. See that carbureter is fitted and wired up properly and all parts are intact.

5—Assemble hot water pipes to motor.

6—Assemble oil feed pipes to motor.

7—Fix ignition tubes to manifold and set cables.

III—Overhaul and Test

1—After an engine has been overhauled or assembled it should have a limber run, in order that all new parts installed can work freely.

2—New engines generally are limbered by power other than their own at about 300 r.p.m., until the motor can be turned over freely by hand.

While thus being limbered motors should be inspected from time to time to note the following:

(1) Cylinders overheating.
(2) Overheating of water pump shaft bushings.
(3) Knocks from piston pins.
(4) Noisy valve actions.
(5) All working parts to be well oiled.

3—Oil pressure is adjusted to a suitable figure at about 300 r.p.m. This is done at this time for the sake of convenience.

4. When the engine is run under its own power at 1400 r.p.m. the oil pressure should be between 45 lb. and 75 lb. The best results are usually obtained when the pressure is about 65 lb.

5—Engines having had a limber or belt run should then be given a limber run under their own power for 5 hr., starting the first hour at 900 r.p.m., the second hour at 1000 r.p.m., the third hour at 1100 r.p.m., the fourth hour at 1200 r.p.m. and the fifth hour at 1400 r.p.m.

6—Inspection must be made from time to time to note if the motor is running smoothly.

(1) No oil leaks.
(2) No water leaks.
(3) Magnetos are working properly.

(*Continued on page* 10)

Getting Skilled Men by Making Them

Turning Bath Attendants and the Like Into Skilled Machine Operators—What the Training Department of the Norton Grinding Co. Is Doing to Counteract Present Labor Conditions

General view of the training department of the Norton Grinding Co., which shows clearly that, so far as equipment is concerned, it is just a regular machine shop

FOR more than 2½ years, at the plant of the Norton Grinding Co. in Worcester, Mass., they have been training employees for special work in a school established for the purpose. They do not call it a vestibule school, and as the term is generally used to indicate that part of a plant where new employees receive a brief and sometimes superficial introduction to the mysteries of regular shop work, the designation "training department" employed by the Norton Grinding Co. is, in their case, more truly descriptive.

Each new employee who enters the training department receives special attention. There is no prescribed course or schedule of hours, days or weeks which govern the particular kind of instruction that is given or the length of time that a student-employee remains in the school. The chief object is to give the men a knowledge of fundamentals and a high degree of skill in a limited field. Just how long it takes an individual to acquire this skill depends entirely upon the natural aptitude of the man himself. Some students remain in the school for 2 and 3 weeks only, and others are there for as many or more months.

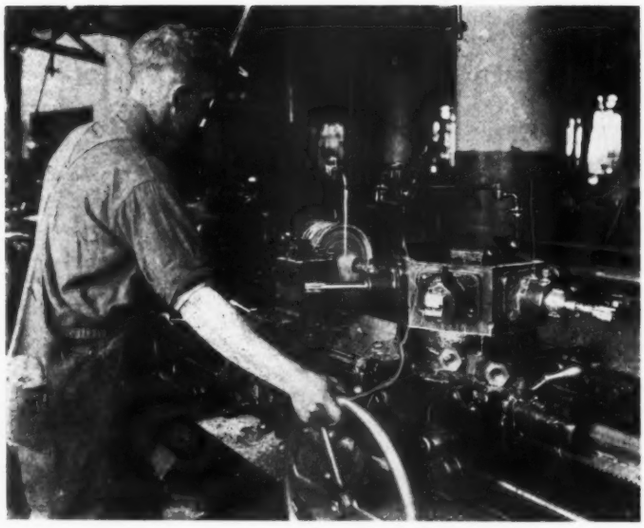
While no attempt is made to produce expert machinists, many of the graduates who had a natural gift for mechanics to begin on have shown a remarkable capacity to learn and have attained astonishing proficiency by the time they have finished their training.

The necessity for this school or training department was made evident during the latter part of 1915, when it became more than ever difficult to obtain men who had previously been trained to the required degree of skill and the increased production demanded by war work made it impossible for the regular foremen to give their time to the breaking in of green help. In December of that year the training department was started and since that time over 300 men and boys have passed through it. The present rate of graduation, as it may be termed, is about five per week.

Training Is Thorough

Only a little more than one-third of those who go through the school are retained in the employ of the Norton Grinding Co., not because the school fails to turn out a satisfactory product but because the men are, to a large extent, lured away to employment in other establishments. Several of the younger men who have gone through the school, some having had more than 4 months' training, have been accepted by the Navy as second class machinists. This fact alone would indicate that the training is thorough and that it is possible, under the system of instruction employed, to turn out mechanics of considerable ability.

The training department is located in a gallery in one of the mills of the Norton Grinding Co., and is 23 ft. wide by 264 ft. long, having an area of 6072 sq. ft. It has its own tool vault, washroom and toilets.



A graduate of the training department. After 8 weeks' training he is operating a Warner & Swasey turret lathe, setting up his own machine, and earning about 45 cents per hour

The machine equipment consists of 17 lathes, 2 vertical milling machines, 3 horizontal milling machines, 1 hand mill, 3 universal grinding machines, 1 shaper, 3 upright drills, 2 sensitive drills, 1 floor grinder, 2 arbor presses, 1 straightening press, 1 gas furnace and 130 ft. of benches.

This equipment was gathered from the various departments throughout the plant and, before the inauguration of the present system of training, was used in these departments for the purpose of instructing beginners. It is evident, therefore, that the training department does not add to the total floor space of the plant. It is in charge of one chief instructor and four assistants.

Regular Shop Work Used for Training

The school serves as an "odd job" department, and the instructors may commandeer work from any department in the plant if they happen to be short of that kind of work for instruction purposes. The cost of doing such work is not considered even when it amounts to several times as much as when done under regular production methods. It is considered a good investment to furnish the training department with whatever it needs in the way of regular work, as the cost of any particular job done there, no matter what it may be, is returned many times through the development of skilled employees.

Beginners in the training department are paid a regular wage according to age and previous experience. Men who have done such work as driving grocery wagons or have engaged in similar occupations are paid at the rate of 35 cents per hour. Boys of from 16 to 20 without previous experience are paid from 17 to 20 cents per hour.

As we have said, there is no definite length of time during which student-employees remain in the training department. In some cases it happens that only a few days are necessary to give those of natural intelligence and ability an amount of training sufficient to produce in them a high degree of skill. In other cases, they are in the school for several months. It is estimated that the average period of training is about 3 weeks.

Foremen throughout the plant have instructions not to employ any unskilled help on production jobs. That is, they must not attempt to teach any beginners themselves how to operate machines or how to assemble them without first taking the matter up with the chief instructor of the school. This method insures the men in the school obtaining the opportunities that arise to get into the shop and at the same time does not prevent any foreman from getting into the school any one in whom he is interested.

As opportunities in the shop arise, the chief instructor of the school takes the men he thinks best fitted to fill the jobs. He does not lose touch with these men immediately after they leave the training department, for it is a part of his work to watch them for a period of several weeks to see whether they are really suited for the work to which they have been put, and it is said that this plan has saved a number of good operators who started out on the wrong line and were eventually diverted to some other kind of work more congenial to them.

The cost department of the plant is notified as each man is sent from the school to the shop, and a special record is made of his work for the 6 months following in order to determine what his earnings are. In this manner an excellent idea is obtained of the value of the men who have gone through the company's training department and how they compare on regular shop work at long-established piecework prices with skilled men who have come through other channels.

It has been found that all but a very few have easily earned up to their day work rating, the average, in fact, being 10 cents per hour over this rating.

Some Transformations

It will be interesting to note one or two of the transformations which have been effected in graduates of the training department. A most interesting example of what can be accomplished in such a school is the present foreman of tool makers on the night shift. Incidentally it may be said that he is regarded by the company as being one of the best tool makers they have on their payroll. He had had absolutely no machine shop experience before he entered the training depart-

After 7 weeks' training this man, who had previously been a teamster, has a regular job in the production department sharpening milling cutters

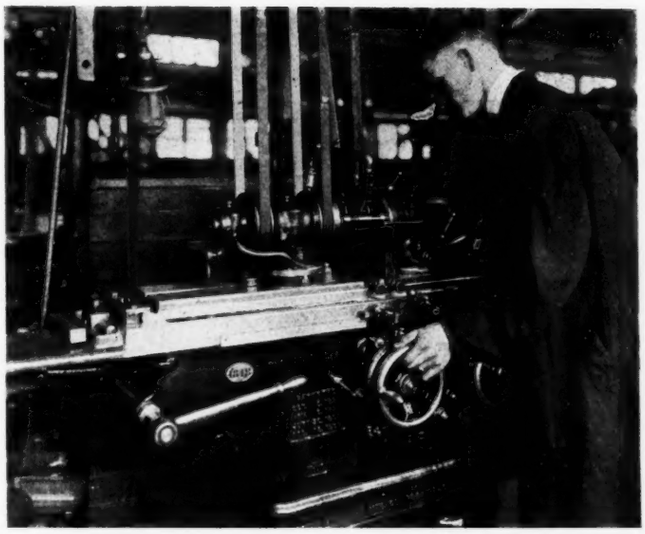
ment in December, 1915. He had been employed by a firm making paper bags.

A teamster who had also had 2 years' experience in a boiler factory, after 7 weeks in the school, is now in the shop sharpening milling cutters.

A designer in a corset shop, after 5 weeks in the training department, is operating a Brown & Sharpe universal grinder.

Another graduate who had no machine shop experience prior to entering the training department, after 8 weeks' training, operates a Warner & Swasey turret lathe, setting up his own machine, and earns 45 cents an hour or more.

A former attendant in a Turkish bath, after 2 weeks' training, is now in the production department operating a No. 3 Cincinnati horizontal milling machine, and the foreman in charge of the department says that he is a better man than he has been able to get directly through the employment department at the present time.



Formerly a designer in a corset shop, this graduate of the Norton Grinding Co.'s training department after a 5 weeks' course is operating regularly a B. & S. universal grinder

The Reasons for a Training Department

A large number of men whose only experience had been in some branch of industry entirely foreign to the machine shop, after a few weeks' training have made milling cutters, machine reamers, arbors and other similar pieces under the supervision of the instructors.

The considerations which led the Norton company to start its training department as stated by John C. Spence, the superintendent in charge, are:

1—Few men have the faculty to teach. Oftentimes the best workman is the poorest teacher. Hence it is easier to find one teacher and let him do the bulk of this work.

2—The press of output prevents a foreman from giving proper attention to beginners even if the foreman happens to be a good teacher.

3—It does not pay to have a high class executive foreman spend time on a beginner any more than a professor of mathematics in a college could afford to put his time into first grade work. In fact, in most cases, he would probably lack the real qualifications for first grade work, i.e., patience and human insight.

4—Unless the schooling is centralized, the corporation cannot readily carry out a fixed policy with regard to teachings other than mechanical, i.e., questions pertaining to honesty of product, citizenship, etc.

5—The influence on the future attitude of these men toward each other and toward industry depends largely on the impression made upon them at the start. This should be controlled as far as possible.

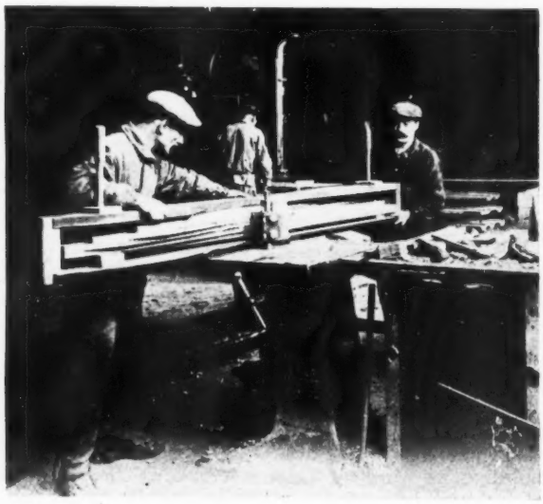
6—In a school, the beginner is sure of a variety of work, whereas the tendency in the shop is to give the beginner such a dose of whatever simple work he can do that he will not disturb the foreman again for some time, or as the boys say, enough to "hold him for a while."

7—The training probably costs less in the school than in the shop, although apparently not, as the true cost in the shop is almost always buried in departmental expense. It is there just the same.

A group of student-employees who are being trained for positions in the production department of the Norton Grinding Co. After a few weeks' training they will become expert operatives

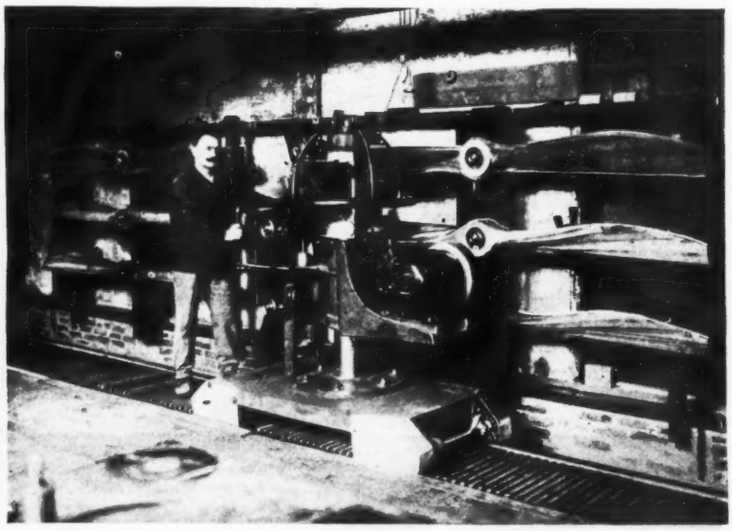
Manufacture of Airplane Propellers

The wood of which the propellers are made is first steamed in these special steaming boxes to make it sufficiently flexible to be easily bent to the required shape



This operation shows the press used in holding the thin wood laminations together during the process of fastening

The propellers are first sawn roughly to shape with a band saw, the final cut being made by machine



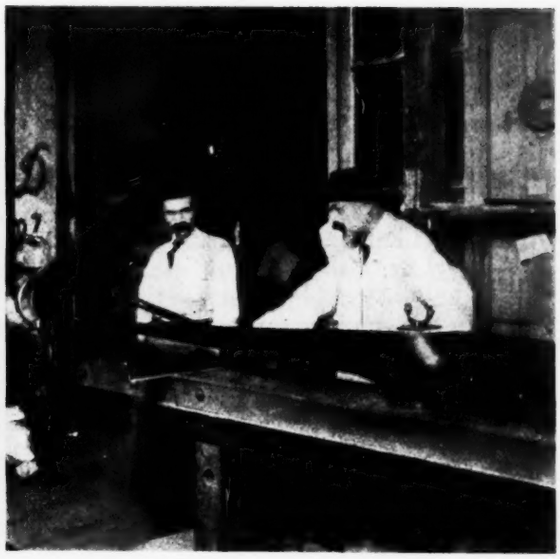
This is the machine that trims the rough-sawn propellers to their final shape. Three propellers are trimmed at once

In this operation the hubs are centered and fastened in place

©Kadel & Herbert, New York

As Carried On in a French Factory

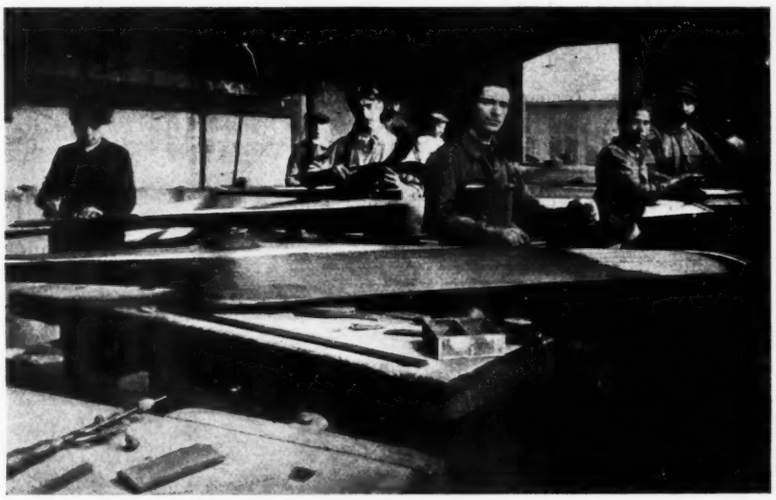
Before the propellers are finally polished they are accurately measured



Final inspection department, where propellers are subjected to minute scrutiny for imperfections in construction and finish

Putting the final touches to a 20-ft. propeller for a naval dirigible

Finishing department, where the propellers are varnished and polished



Putting on the copper tips, this being one of the last operations completed

Complete Inspection Procedure for Airplane Engines

(*Continued from page* 4)

(4) Take reading of water at inlet and outlet. Intake should be about 110 deg. and outlet 140 deg. F.

(5) Take reading of oil pressure.

(6) Look for oil leaks at thrust bearing and clamps.

(7) Oil leaks at magneto drive shaft oil deflector and crankcase joints.

8—At the end of 5 hr. run, valve clearance must be adjusted to proper valve.

9—Remove oil from sump and replace with clean oil. It is then ready for 5 hr. full power run.

10—Start engine and run 15 min. to warm up—then open up to full power 1400 r.p.m.

11—On this run very careful inspection must be maintained.

(1) Take readings of oil pressure, temperature of water inlet and outlet.

(2) Note overheating of cylinders.

(3) Note proper working of magneto.

(4) Take readings of torque in lb. and static thrust in lb.

12—At the end of 5 hr. full power run, the following defects may appear:

(1) Oil leaks at thrust bearing clamp ring, due to a poor gasket or loose thrust bearing clamp bolts.

(2) Oil leaks at thrust bearing clamp ring, due to not having enough clearance between ring and thrust bearing clamp. Nothing less than 0.010 in. to be tolerated.

(3) Oil leaks at magneto drive shaft.

(4) Inspect for water leaks on all cylinders, water connections and water pump packing glands. Observe carefully brazing of cylinder water jackets at bottom and top, as the brazing sometimes opens.

(5) Valve actions that are out of alignment will be noisy. Weak intake push rod springs will also cause noisy valve action.

(6) Inspect intake and exhaust push rod yoke pins for wear.

(7) Check valve clearance.

(8) Inspect manifold for cracks at flanges, air leaks at manifold gaskets, elbow gaskets, and carbureter gaskets. Air leaks at these points will make engine run uneven and prevent throttling down to low speed. The engine will also overheat.

(9) Carbureter should be checked up for the settings.

(10) Check oil consumption and temperature.

IV—Overhaul Inspection

1—CYLINDER INSPECTION.

(1) Inspect cylinders for score in bore.

(2) Cracks in cylinder head at port holes and around studs. Dents in water jackets.

(3) Test valves with gasoline for tightness.

2—INSPECTION OF CONNECTING ROD AND PISTON ASSEMBLIES.

(1) Inspect connecting rod bearings for cracks, scores and porosity.

(2) Inspect pistons for cracks around pin bosses, supporting ribs and skirt. Piston must be free of scores.

(3) Piston pin lock set screw should be tight and wired.

(4) Test piston pin for bearing fit.

3—CRANKSHAFT INSPECTION.

(1) Inspect crankshaft main and pin bearing for checks, scored bearings and thrust bearings. Shaft must be clean inside and out.

4—CRANKCASE INSPECTION.

(1) Test all studs for tightness in crankcase.

(2) Inspect case very closely for cracks at cylinder stud bosses, bearing cap stud bosses and all supporting members and flanges.

(3) Main bearings must be free from cracks, scores and porosity—bearings countersunk for attaching screws and screws must be kept tight.

(4) Camshaft assembled in crankcase. See that shaft has end play of 0.002 in. to 0.006 in. Other clearances are explained in assembly inspection. All bearings must be tight in case and locked with retaining screws.

Camshaft gear tight on shaft and locked.

Inspect all cams, as checks may have developed.

5—LOWER CRANKCASE.

(1) Inspect for cracks at all corners and at oil pump.

(2) See that oil strainer is well soldered at top and bottom, also that supporting strips are well soldered.

6—Inspect gear covers for cracks and porosity.

7—After crankshaft has been fitted in case, it should be free from tight spots and turn freely by hand. All main bearing stud nuts to be securely cottered.

8—Inspection from here on is the same as in the first assembly.

9—Inspection of 1 hr. final test is same as in 5 hr. full power test, except that all readings are taken at 15 min. intervals.

Engines that have had one or two bearings replaced must have a 1 hr. limbering run and a 1 hr. test.

10—Final inspection of engines after 1 hr. test.

(1) All nuts to be cottered, except lower cylinder tie-down nuts which are locked with special washer lock.

(2) All screws to be locked with wire.

(3) Lower crankcase must be dropped on all motors that have had three or more bearings replaced. Inspect oil sump.

(4) Rocker arm lock set screws to be locked with wire. Engine to be cleaned and all steel parts covered with oil before shipped.

11—OVERHAUL OPERATIONS.

(1) Tear down motor.
(2) Wash and return.
(3) Grind valves.
(4) Clean piston and connecting rod assembly.
(5) Fitting crankshaft and connecting rods.
(6) Replace cylinders, lower pan and cotter up.
(7) Replace manifolds and valve actions.
(8) Replace water pump, carbureter, water pipes finish for test.

Return from test for final adjustment for shipping.

Airplane Nomenclature

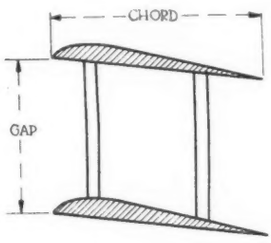
Names of the Different Types of Planes Used in Warfare and of Their Principal Parts, Together with Expressions for Features of Airplane Design

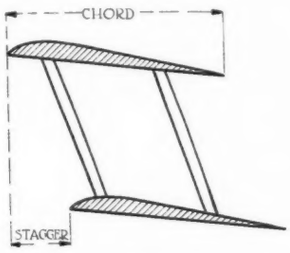
THE illustrations shown on this and the following pages are reproduced from F. L. Faurote's paper on Airplanes of To-day read before the Society of Automotive Engineers at Dayton recently. Familiarity with the terms used in aeronautics will enable the reader better to follow discussions on aircraft topics. For the purpose of illustration, Mr. Faurote used the standard training machine known as the JN-4D. This machine is a biplane of the tractor type, a two seater primary training plane equipped with a 90-hp. eight cylinder aircraft engine.

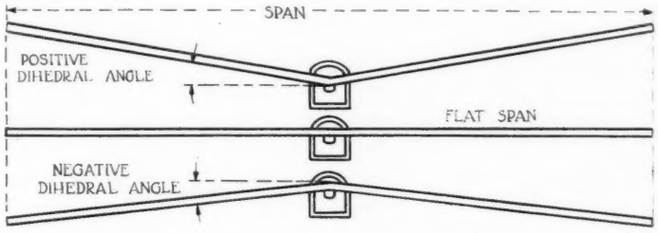
The illustrations also show the different types of airplanes defined by Mr. Faurote in his paper reprinted in AUTOMOTIVE INDUSTRIES last week. Mr. Faurote divides military airplanes into five classes, viz., combat machines, reconnaissance and photograph machines, battleplanes, bombers, flying boats and hydroplanes.

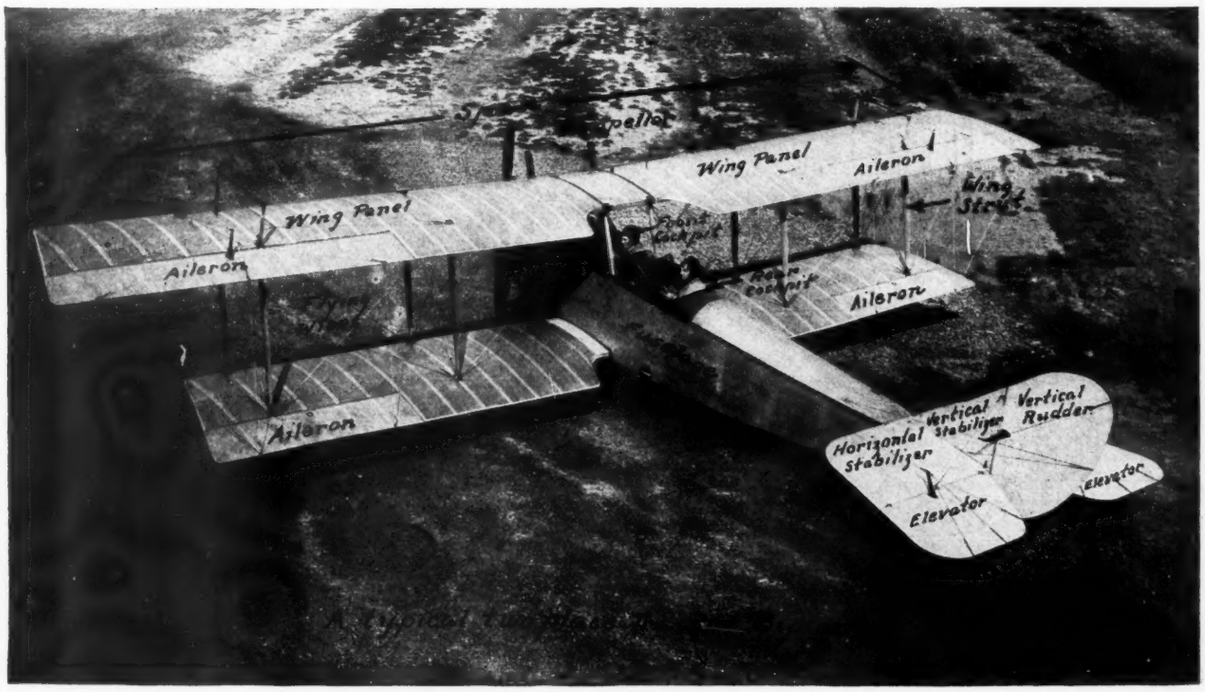
Mr. Faurote's plan of writing the names of the parts on a large sized photograph of the complete plane has much to commend it. In this way the relation of the part named to the whole plane is at once made evident. General characteristics of the design, such as span, gap, chord, angle of incidence, dihedral angle, stagger, etc., are illustrated by diagrams in a very clear manner. While to not a few of our readers the terms illustrated and described are household words, to others they are new, and as at the present time practically every one is interested in aircraft and aircraft literature, this brief contribution to the subject of aircraft nomenclature should be of general interest. One cannot well begin the study of any technical science without a good knowledge of its nomenclature.

The rapid strides which have been made in aircraft development during the past four years are well illustrated by the number of different types evolved. In military operations quality of equipment is a very important factor, and in order to secure high quality for any particular purpose, that one purpose must be kept in view to the exclusion of everything else. This leads to multiplication of types.



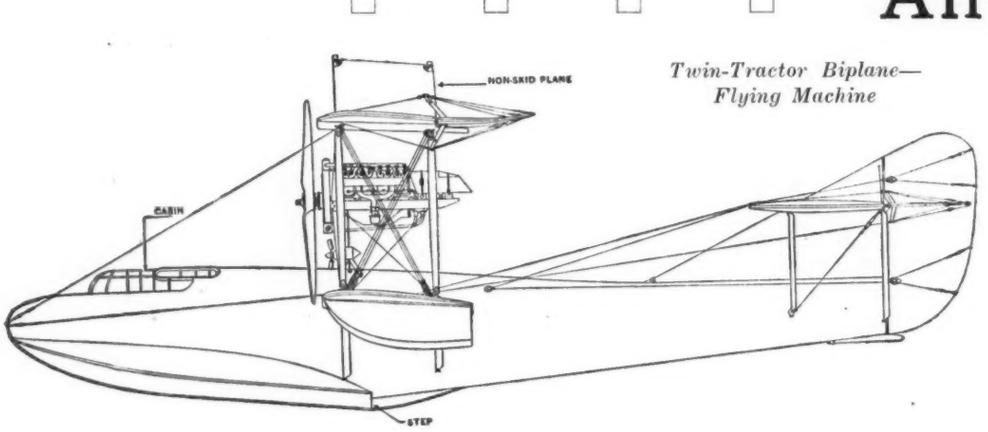




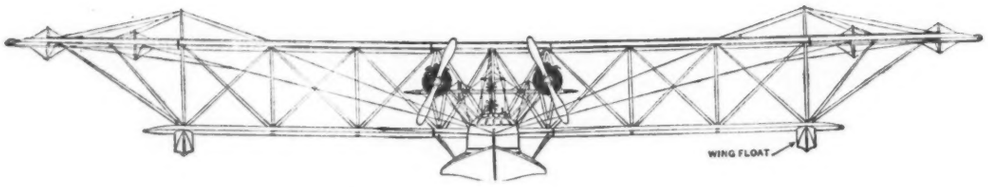


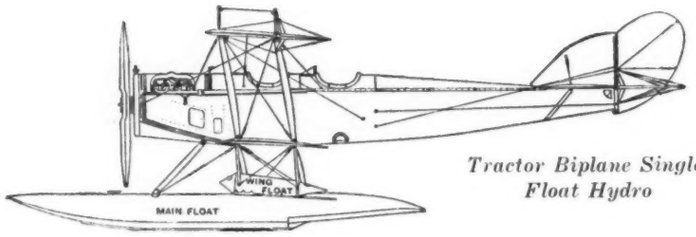
Well-known terms used in aeronautics

Airplane

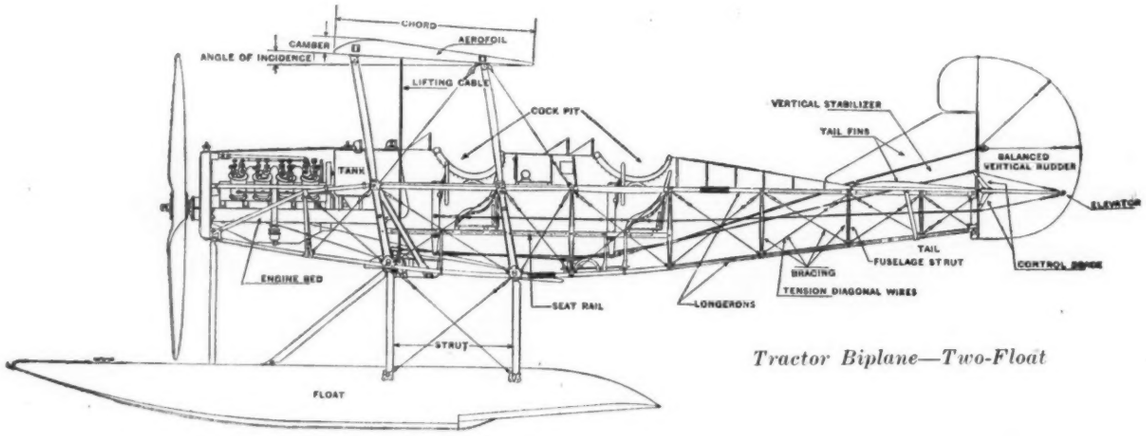


Twin-Tractor Biplane—Flying Machine

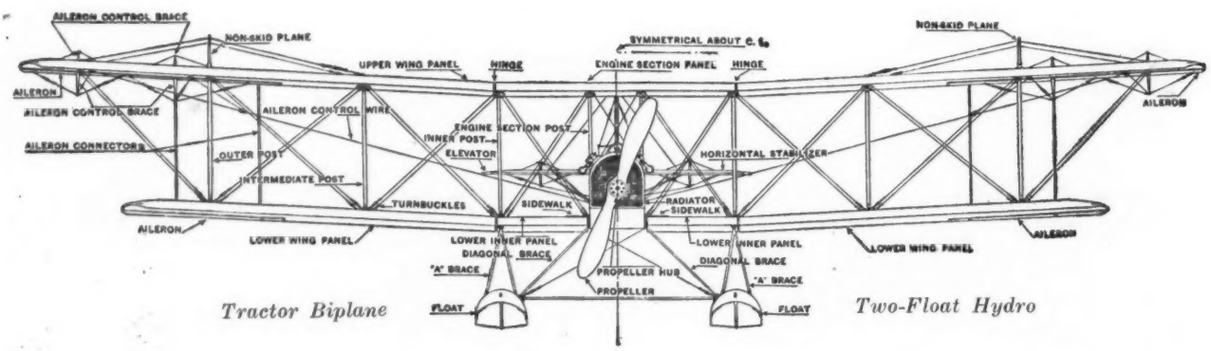




Tractor Biplane Single Float Hydro

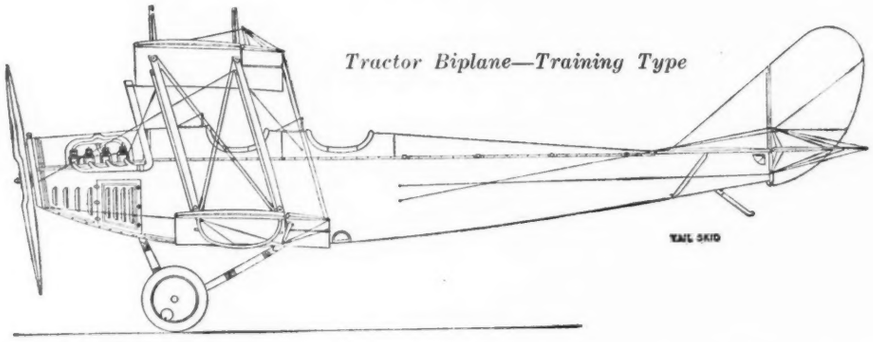


Tractor Biplane—Two-Float

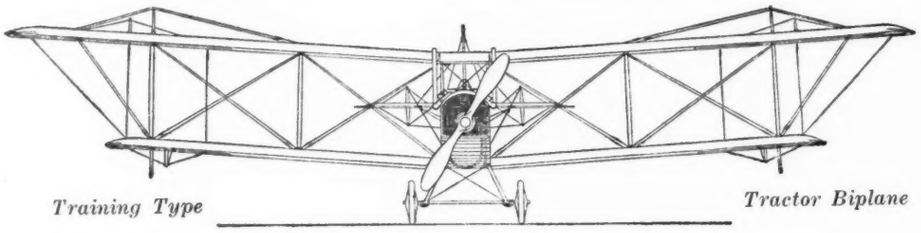


Tractor Biplane *Two-Float Hydro*

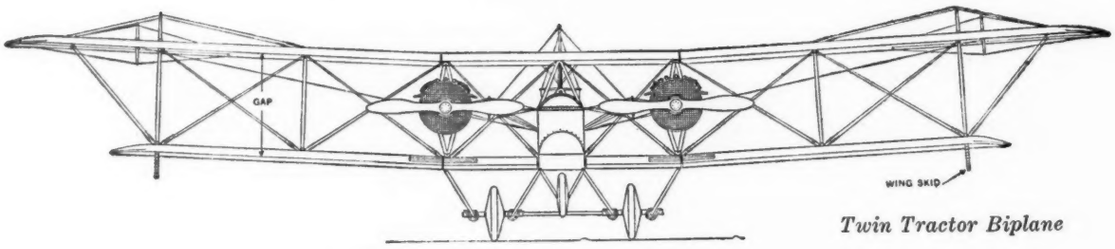
Nomenclature



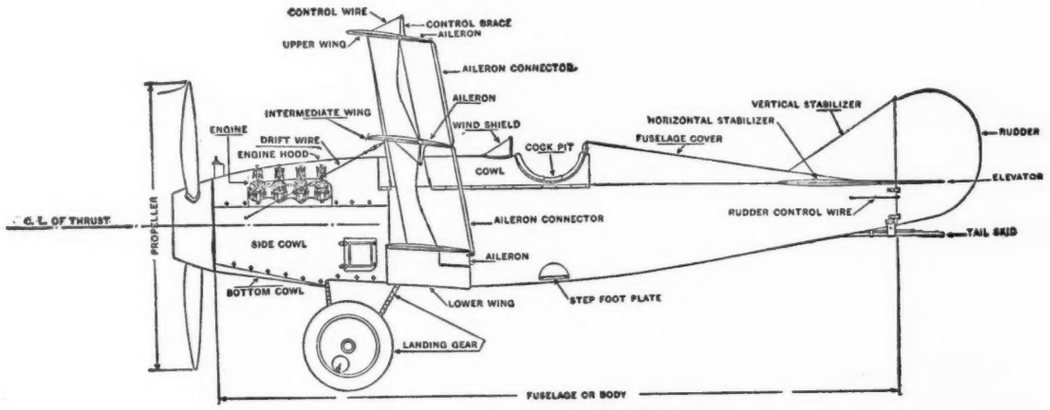
Tractor Biplane—Training Type

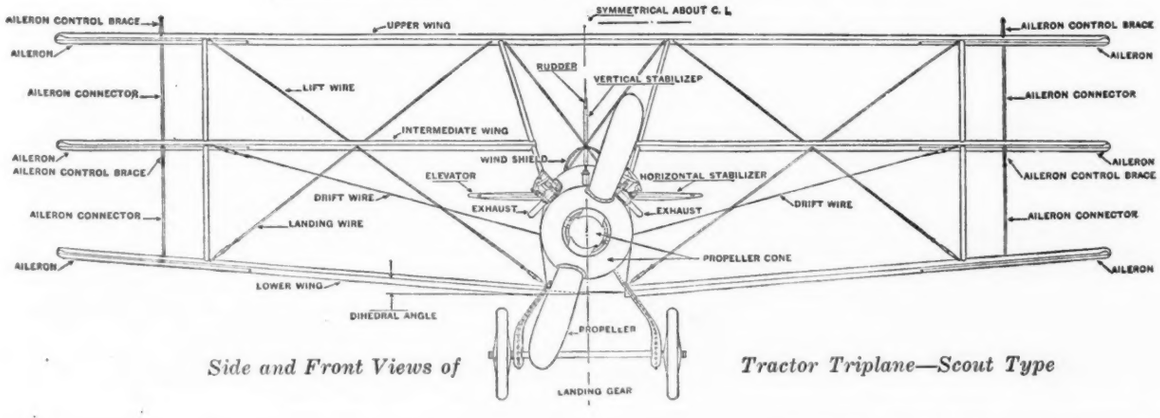


Training Type *Tractor Biplane*



Twin Tractor Biplane





Side and Front Views of *Tractor Triplane—Scout Type*

War Airplanes of To-Day

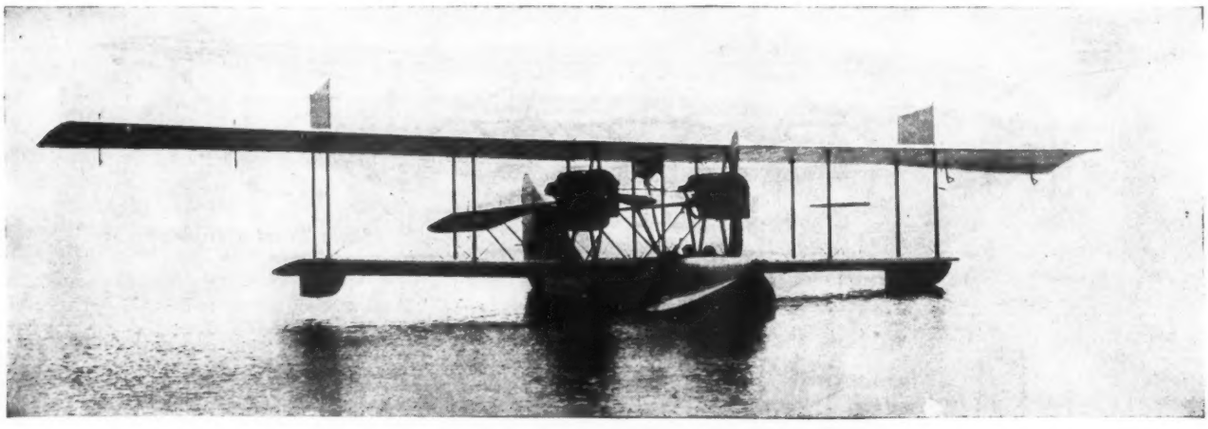
A Comprehensive Collection of Photographs and Descriptions of the Scout, Reconnaissance, Battle and Bombing Planes and Flying Boats in Use in the World War

IN his paper, "Airplanes of To-day," which was read before the summer meeting of the Society of Automotive Engineers, Fay Leon Faurote of the Curtiss Aeroplane & Motor Corp. illustrated and described in detail the various types of airplanes in use to-day by the warring powers in Europe and in the training schools in America.

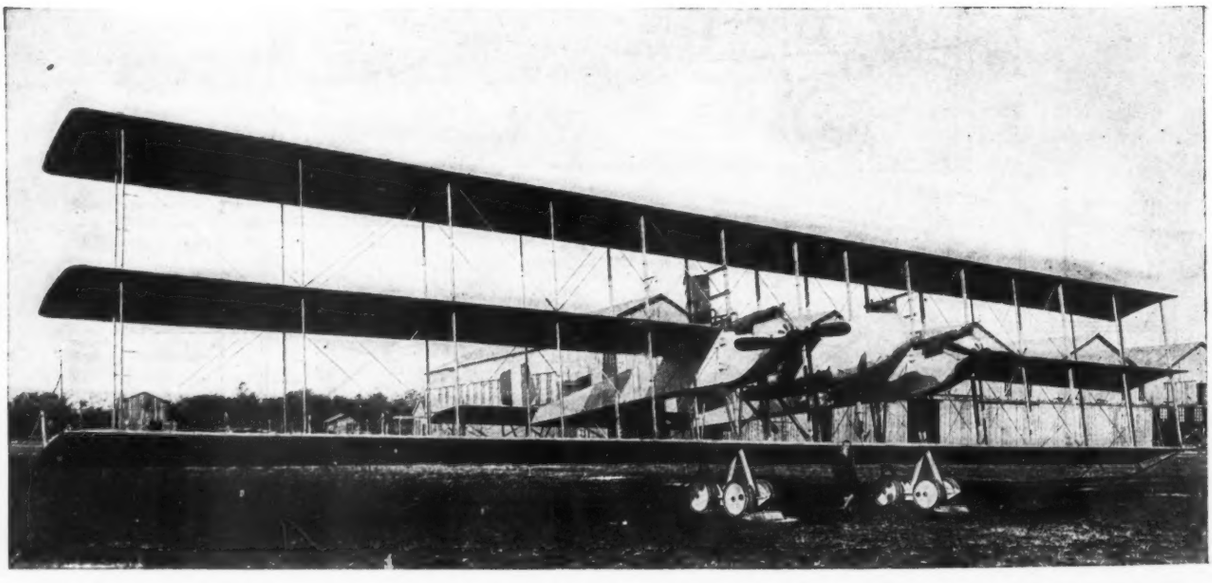
Several of the types which Mr. Faurote took up have already appeared with complete descriptions in past issues of AUTOMOTIVE INDUSTRIES. On the following pages we are reproducing illustrations and descriptions of those planes which have so far not been treated fully in this publication. The latest types of French, British, Italian, German and American planes will be found in the unusual collection of photographs here presented.

The planes shown are arranged in general classes according to the purpose for which they are designed. The pursuit and scouting planes come first. These machines have speeds of from 125 to 135 m.p.h., can carry up to 450 lb. and will climb at the rate of 10,000 ft. in from 8 to 12 min.

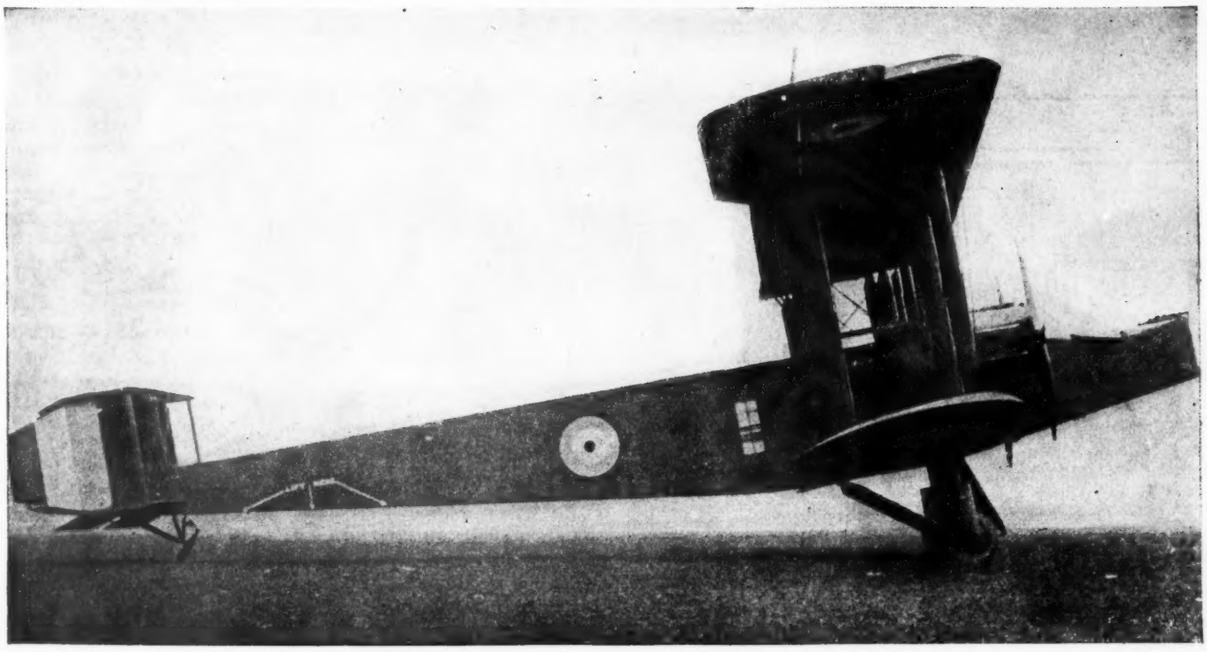
Following these small, fast machines come the reconnaissance and photographing machines, which are slower and are intended chiefly for observation work in con-



Large Curtiss flying boat



The big Caproni triplane. Next to the large Curtiss t riplane boat, it is the largest triplane that has been built and successfully flown



A side view of the Handley-Page bomber

nection with artillery and general reconnoitering. They have wing spreads of from 40 to 60 ft. and are capable of making from 80 to 100 m.p.h. They are two or three seaters and their climbing speed is about half that of the pursuit and scout planes.

In the third group are the battleplanes, usually equipped with one large or two medium sized engines and a number of machine guns, sometimes even mounting small cannon. They carry two or three passengers and can attain speeds of from 70 to 85 m.p.h.

The bombing planes, which come next, are, so far as general type goes, similar to the reconnaissance and photographing planes, but somewhat larger. Their radius of operation is from 500 to 1000 miles and their speed from 75 to 100 m.p.h. They have a wing spread of from 45 to 90 ft. and can climb at the rate of 1000 ft. in approximately 4 min.

The author's last classification is flying boats and hydroplanes, which are made in a great variety of types and sizes. They are used for coast patrol work and for naval observation. They are capable of relatively high speed, making from 90 to 100 m.p.h.

Pursuit and Scout Planes

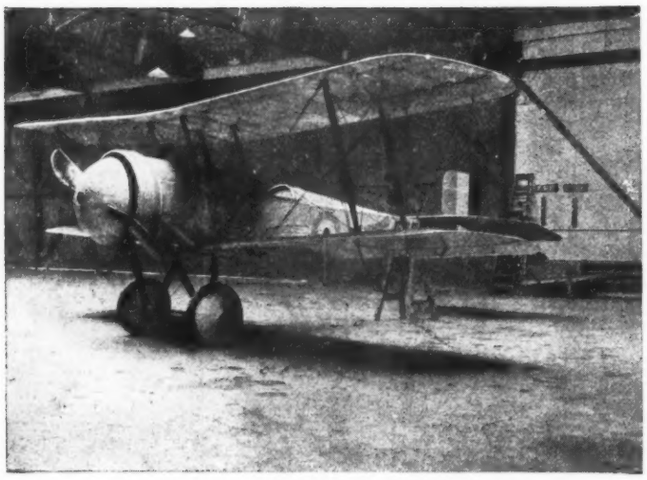
BRISTOL TRACTOR MONOPLANE

Small one-seater machine. Span, 30 ft. 9 in.; chord, 5 ft. 11 in. Overall length, 20 ft. 7 in.; height, 9 ft. 6 in. Driven by 110-hp. Clerget that uses about 6 gal. of fuel per hour. Air endurance, about 3 hr. Total flying weight, about 1320 lb., of which 410 lb. is useful load.

This machine requires a clever pilot to fly it, although it is comparatively easy to land. It is nose-heavy and has a tendency to turn to the right with the engine on. This model is credited with a speed of 128 m.p.h. at 5400 ft. and 110 m.p.h. at 15,000 ft. It will get off the ground in less than 100 yards, and can be stopped, with the engine off, in a little more than the same distance. It will climb about 16,000 ft. in 20 min.

To the eye it presents a pleasing appearance and offers a good example of stream-lined monoplane construction. The

Front and side views of the Bristol monoplane (English)



Bristol scout plane (English)

dihedral is 4 deg. and the tail plane has a small negative angle of incidence.

BRISTOL SCOUT MODEL D TRACTOR BIPLANE

Powered with an 80-hp., air-cooled Clerget, this one-seater is credited with a speed of about 95 m.p.h. It weighs about 1100 lb. and has a wing spread of 24 ft. 5 in. Length, 20 ft. 5 in.; height, 9 ft. 8 in. Its wings have a dihedral of 3 deg., angle of incidence of 2 deg., stagger of 1 ft. 4 in. Its aspect ratio is 5.5; chord, 4 ft. 6 in.; gap, 4 ft. 4 in.

The Bristol Scout is also equipped with 100- and 110-hp. Clerget engines. It is a very easy machine to fly, not at all tiresome, and lands easily. It will climb 10,000 ft. in 26½ min. Its weight is 1099 lb.

MORANE PARASOL WITH 170-HP. GNOME ENGINE

This is the only monoplane now in use on the French front, but on account of its good visibility and quick maneuvering ability, it is particularly well liked by many pilots. Span, 21 ft.; gross weight, 1400 lb., and useful load, 500 lb. Its maximum speed is 136 m.p.h. at sea level. It will climb 16,000 ft. in 16 min. It carries two machine guns and gasoline for 1¾ hr. A jack-seat for the gunner is operated by a crank with which he can raise and lower himself. The plane is of steel construction (two-thirds of the fuselage). There are no wires; the bracing is of steel. It has a monocoque body, a pointed nose and small tail. It is light, speedy, sensitive and very trim.

MORANE THREE-PLACE TRACTOR

Two rotary Rhone engines or Hispano-Suiza engines. There are two pairs of vertical struts and two pairs of inclined struts on either side of the fuselage. The landing gear is of a double M shape, and the machine is easily recognized by its fish-like fuselage. Its nacelles, in which the engines are carried, are mounted in V-shaped supports. The upper wing has a slight overhang, no dihedral and no sweepback. The German A.E.G. and Gotha are very much like this machine and many of their features are copied from it.

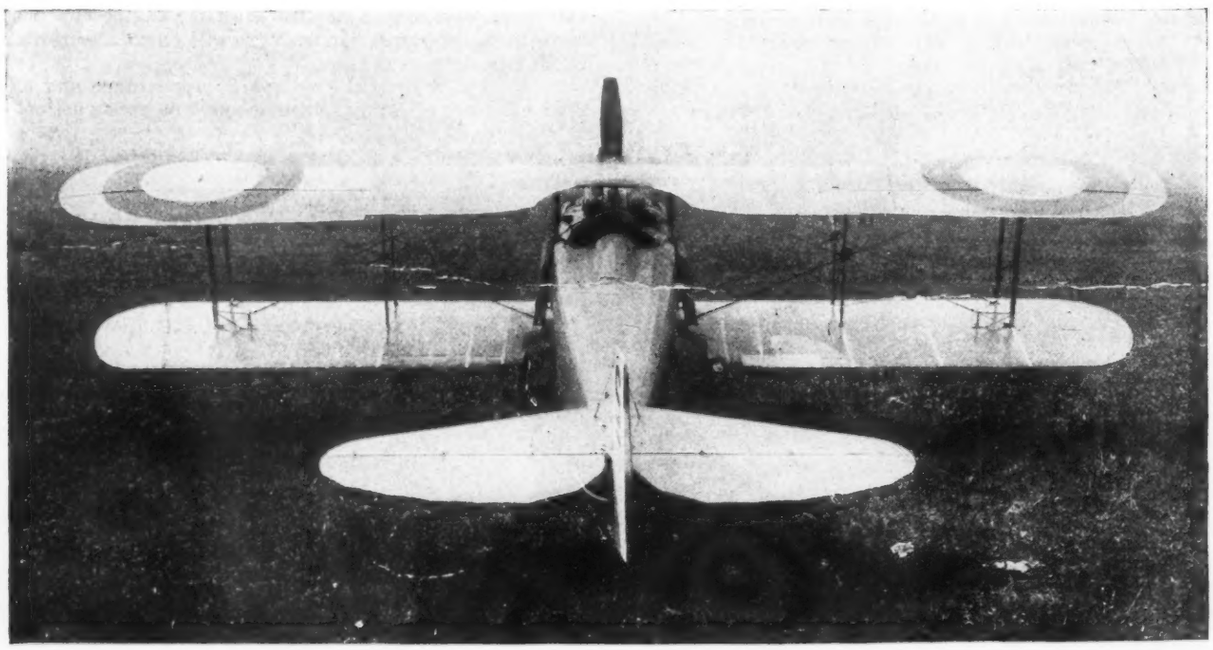
The propeller is equipped with propeller-pot which aids in cutting down the head resistance of the machine. The planes are cut away for visibility. The elevators are of the balanced type.

The under-carriage structure has an M type of truss, and looks something like the Fokker and Halberstadt—which are German imitations of it.

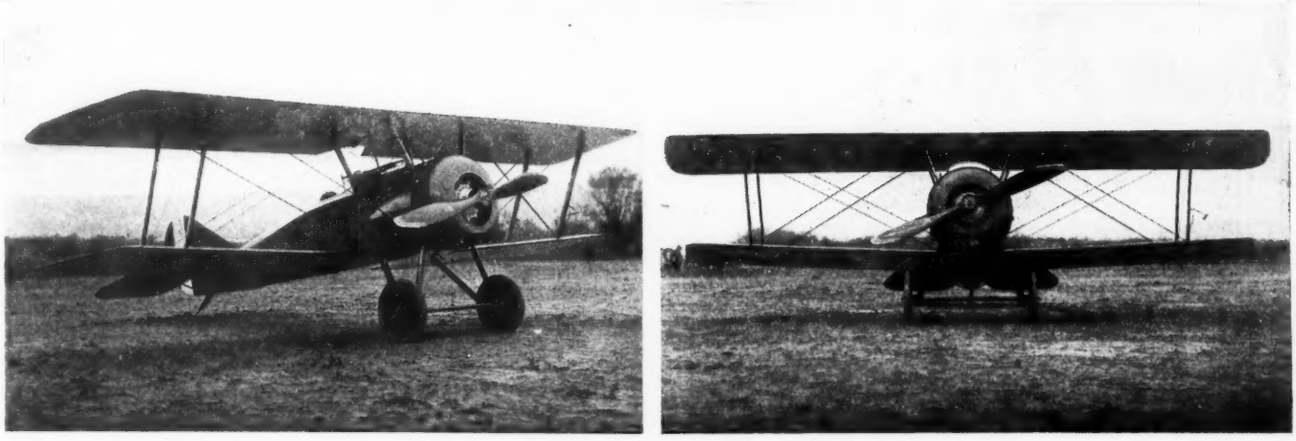
TWO-SEATER POMILIO WITH 6-CYLINDER, 200-HP. FIAT ENGINE

Is 38 ft. wide, 10 ft. high, 30 ft. long and will make 120 m.p.h.; climb 13,120 ft. in 22 min. Two sets of struts on either side of body. Double set of V-shaped struts from fuselage to upper plane. Very narrow but high cowl. Apparatus for release of bombs just below rear cockpit. Movable machine-gun mounted on a rotating ring in rear cockpit.

Morane Parasol (French)



Rear view of Spad



Two views of the Thomas Morse S4C (American)

The ailerons on the upper plane increase in chord as they leave the trailing edge of the main plane. The trailing edges of the lifting and controlling surfaces are fluted.

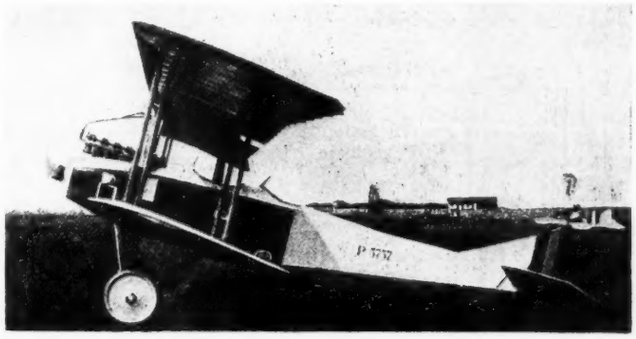
Spad French Pursuit Biplane

The Spad is a single-seater, combat or pursuit biplane, with a 150 to 200-hp. Hispano-Suiza engine. It has a speed of from 120 to 130 m.p.h., and is an excellent example of good streamline design. The panels are of veneer construction, and the beams are made up of an I-beam section with two side pieces wrapped on with fabric. It is a remarkably good example of wood construction, veneer and aluminum being used in a wonderful manner. The French apparently do not like balanced units, but prefer a machine having the sensitiveness that unbalanced units give. It is said that they are much easier to maneuver in battle, can make turns and dive with greater facility. The Spad is so wonderfully made that even bad smashes do not seem to have much effect upon its structure. It has a 25-ft. spread and a 5-ft. chord. The chord is slightly greater than that of the Nieuport. The fuselage is very short.

The machine is very light in construction—almost an engine with wings. The gross weight is 1500 lb., and it carries a useful load of 450 lb. It will climb 10,000 ft. in 9 min. Two years ago with a 150-hp. engine it attained 118 m.p.h.; last year with a 200-hp. engine it reached a speed of 131 m.p.h.

S4C Single Seater (The Thomas Morse Co.)

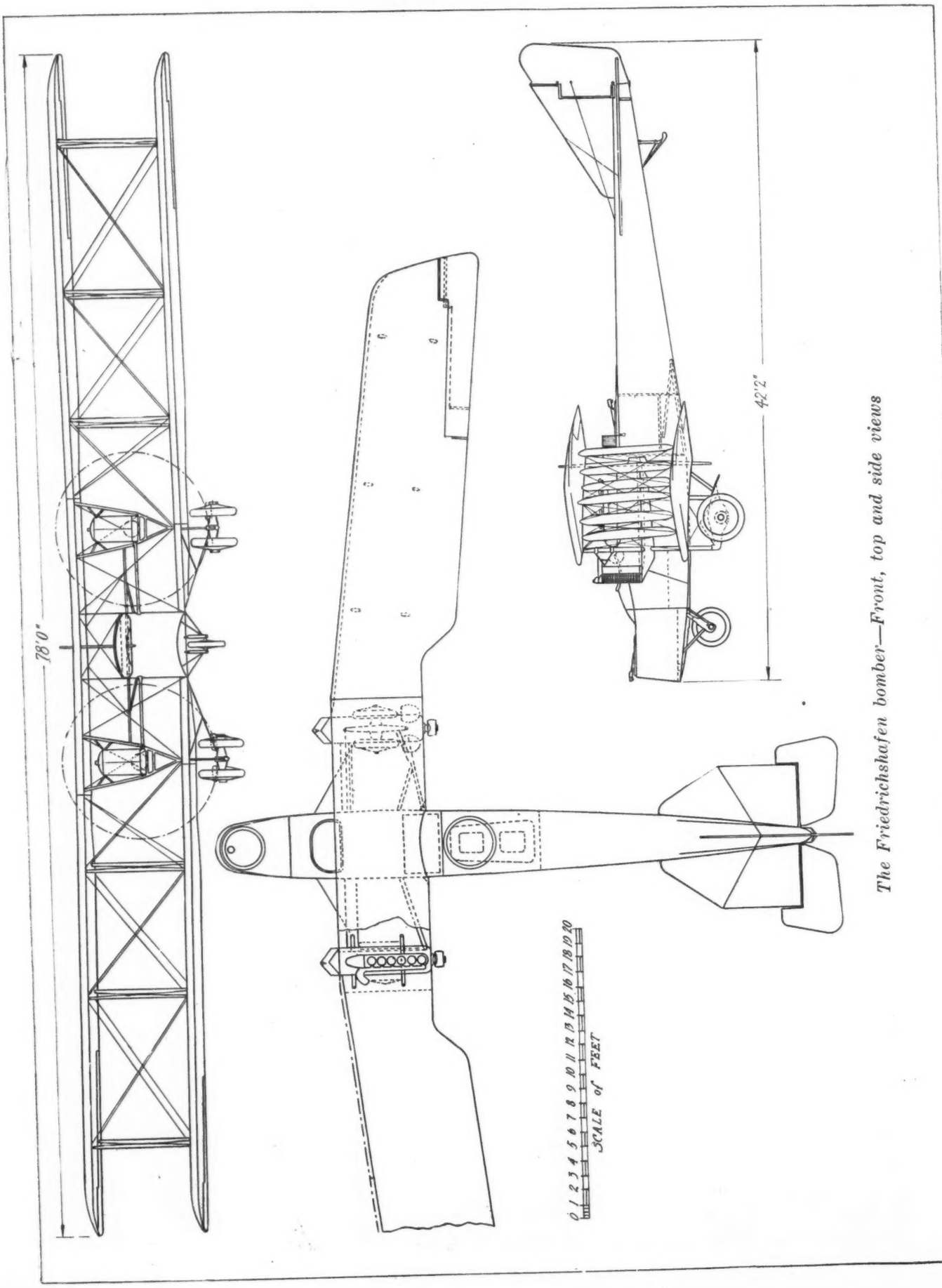
This is fitted with 100-hp. Gnome or LeRhone 80-hp. engine. It has a wing spread of 27 ft.; length over all, 18 ft.; total weight, with LeRhone engine, 1300 lb. It has a climbing speed of 9500 ft. in 10 min. with the Gnome, and 8500 ft. in 10 min. with the LeRhone. It has a high speed of 105 m.p.h. with the rotary and a high speed of 95 with LeRhone.



Pomilio (Italian)

(*To be continued*)

Body construction of Spad (French)



The Friedrichshafen bomber—Front, top and side views

Friedrichshafen Bombing Plane

Details of One of the Latest Designs of German Long Range Bombers

AMONG the German types of large bombing biplanes the Gotha is probably the best known; but two other types have been used by the Germans in long-distance bombing flights recently, the Friedrichshafen and the A. E. G. The former is supposed to be the product of the Zeppelin Works located on the shores of Lake Constance and at other places in Germany. It is believed that Friedrichshafens, together with Gothas, took part in the most recent raid on London, and the Aircraft Production Department of the British Ministry of Munitions has issued considerable interesting material concerning this machine.

One of the Friedrichshafen bombers was downed at Isbergnes during the night of Feb. 16 by a direct hit on the right-hand engine from an anti-aircraft gun. The machine when hit was traveling at a height of from 8000 ft. to 9000 ft., and thereafter covered a distance of about 6 miles before landing in a fairly good manner. It would seem to have been of very recent construction, for on the tail appeared the date "14/1/18." On other parts, however, different dates were marked, so that possibly it may have been a somewhat older machine that had been repaired. From data painted on the side of the body, it is to be gathered that the weight of the machine, when empty, was 5929 lb., its useful load 2717 lb., and its permissible total weight 8646 lb.

The general arrangement of the machine is illustrated in the accompanying drawing. Its full complement consisted of four persons, the pilot, a fore-gunner, an after-gunner, and a bomber. The number of the crew carried by this type of machine is, however, known to vary, two only being sometimes carried. The cockpits for the crew intercommunicate in such a way that the men can easily change places.

The machine may be described as consisting of a central section to which are attached the main planes and the forward and rearward portions of the fuselage. This central section comprises the main cell or cabin of the body, wherein are carried the tanks and bombs, and also embraces the engines and the central portions of the upper and lower planes. The central portion of the body measures 4 ft. wide by 4 ft. 3 in. high, and is of box formation. It is carried out in ply-wood, strengthened by longerons and diagonals, and stiffened transversely by ply-wood bulkheads. The bulkhead furthest forward serves as an instrument board, and behind it are placed two seats side by side for the pilot and his assistant. The pilot has a fixed upholstered seat, while his assistant is provided with a light steel tubular folding seat having a webbing back-rest. Beneath these two seats is placed the lower main fuel tank. Behind the pilot's cockpit the body is roofed over with ply-wood. The rear part of this roof is detachable, so as to give access to the second main fuel tank at the rear end of the main body portion. At each side of the cabin or covered passageway thus formed are racks for small bombs. These racks are each capable of holding five 25-pounder bombs. Beneath the nacelle are two large racks formed of tubular frames and fitted with cradles of steel cable and trip gear. Each of these racks is believed to be capable of supporting a 600-lb. or 700-lb. bomb. The large racks are readily detachable, for the bombs carried are evidently varied to suit the radius of action over which the machine has to operate. The bomb sight is of the ordinary German non-precision type.

The machine is driven by means of two 260-horsepower six-cylinder Mercedes engines. The engines of the Friedrichshafen bomber show only a few changes in the design, that of chief interest being the fitting of a rudimentary form of silencer to the end of the exhaust pipe. Following are the principal dimensions of the machine:

Span, ft.	78
Maximum chord	7⅔
Gap, ft.	7
Dihedral angle in the vertical plane, deg.	1½
Dihedral angle in the horizontal plane, deg.	6
Total area of main planes, sq. ft.	934.4
Area of upper main planes without flap, sq. ft.	480
Area of lower main planes without flap, sq. ft.	454.4
Load per square foot, lb.	9.24
Weight per horsepower, lb.	16.6
Upper wing, area of flap, sq. ft.	21.6
Upper wing, balance area, sq. ft.	1.8
Lower wing, area of flap, sq. ft.	16
Lower wing, balance area, sq. ft.	1.56
Tail planes, total area, sq. ft.	57.6
Elevators, sq. ft.	32
Balance area of one elevator, sq. ft.	1.7
Area of fin, sq. ft.	20
Area of rudder, sq. ft.	19.2
Balance area of rudder, sq. ft.	3
Maximum cross section of body, sq. ft.	19.2
Horizontal area of body, sq. ft.	133
Vertical area of body, sq. ft.	131.2
Length overall, ft.	42

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A German Aircraft Speed Meter

A SPEED meter for aircraft was described some time ago in the *Elektrotechnische Rundschau*. The mechanism consists of an iron rod or track laid horizontally and in the direction of the aeroplane's length. On this rod is a heavy iron ball, which is normally held at the center of the track by a spring at each end of the latter. When the aeroplane is accelerated the iron ball moves backward from the center of the track; when the machine is retarded the iron ball moves forward. The second part of the mechanism is a horizontal disc rotated at constant speed by clockwork. On this disc rests a small wheel, which is mounted on and can slide along a square shaft. By means of a prong or fork the iron ball moves the small wheel to one side or other of the center of the rotating disc. The direction of rotation of the small wheel (and of its square shaft) and its speed of rotation are thus determined by the direction and extent of displacement of the iron ball, *i.e.*, by the degree of acceleration or retardation of the aeroplane. The square shaft is geared to a recording dial, which indicates the net total revolution of the small wheel at any time. This is proportional to the speed of the aeroplane with regard to the earth. The recording dial may be calibrated accordingly. If the instrument is working properly the speed dial comes back to zero at the conclusion of each flight.

The idea involved in this device is not altogether novel. The theory underlying it is fairly simple and can be worked out without resorting to the methods of the calculus, if we confine ourselves to constant accelerations. In practice, the accelerations with which the device has to deal are in general not constant, and the instrument has to exercise an integrating function. At first sight it might be thought that the inertia of the ball would introduce a disturbing effect, for under a sudden acceleration the ball would overshoot its true position. It would, however, subsequently vibrate with decreasing amplitude about its true position.

Heavy Oil Engines for Automotive Purposes*

Difficulties of Handling Heavy Fuel in Carbureters—The Diesel's Principle, Its Advantages and Shortcomings—Junkers Type Double Piston Engines

By P. L. Scott

THE necessity of developing the heavy oil-burning engine for automotive purposes cannot be too strongly emphasized. The demands for automotive power for the farm, for freight carrying and trucking of all kinds, for the automobile for both passenger and business purposes, for the small power boat, and for the airplane, are increasing by leaps and bounds. We have not enough suitable gasoline to supply even our present requirements, and we have almost no engines capable of successfully burning heavier distillates. The supply of such heavier distillates is comparatively vast, and the heavy oil engine will use this supply much more economically than the gasoline engine uses gasoline.

Oils as Gasoline-Engine Fuels

The present type of gasoline engine does not burn with success (and by success we mean good combustion at all loads) kerosene, or even a mixture of gasoline and kerosene in which the proportion of kerosene is high; nor do many of these engines burn kerosene well even at full load. This is because kerosene will not volatilize at ordinary temperatures and pressures, and low-grade gasoline, now very common, volatilizes only partly under normal conditions. Volatilization is essential if the oil is to be mixed with the air by any of the present forms of carbureter. The vaporization of the heavier oils can be assisted by heating, but even then is not sufficient to produce a complete and homogeneous mixture of oil vapor and air. If gasoline and kerosene are placed side by side in two receptacles exposed to the air, the gasoline will disappear by evaporation long before the kerosene. Attempts to apply heat frequently fail of their object because the heat does not sufficiently aid in volatilizing the oils, and, more important, because it decreases the weight of oxygen drawn into the cylinder of the engine. The amount of power is dependent upon the amount of fuel that can be burned, and the amount of fuel that can be burned is dependent in turn upon the amount of oxygen that can be drawn into the cylinder at each charging stroke. Heating of the air decreases its density, consequently reduces the amount of oxygen and correspondingly cuts down the power output.

Many have expressed the opinion that the next logical step to meet the fuel situation is the design of an engine especially suited to the burning of kerosene or of the lower petroleum distillates and the lighter and possibly "middle oils" resulting from the by-product distillation of coal, and not an attempt to adapt engines designed for a volatile oil to the use of relatively non-volatile oils.

Burning Low-Grade Liquid Fuels

The author believes that with a heavy fuel engine some means other than carburetion must first be provided for the most intimate mixing of the fuel and the air, and that some means of igniting this mixture other than an electric spark is necessary. A heavy oil cannot be successfully mixed with air in a carbureter, and a spark cannot successfully ignite a mixture in which the oil is not to a considerable extent vaporized. Carbureters fail to form an intimate mixture of heavy oils with air because the heavy oils do not volatilize sufficiently well, and the mechanical division of the oil secured in the carbureter is never sufficiently fine to form a combustible mixture. Heat applied to the carbureter in order to assist in volatilizing the oil results in heating the air, and thereby reduces the output of the engine. An ordinary electric spark will usually fail to ignite a mixture of heavy oil and air because the source of heat is too localized

*Paper read at the S. A. E. summer meeting.

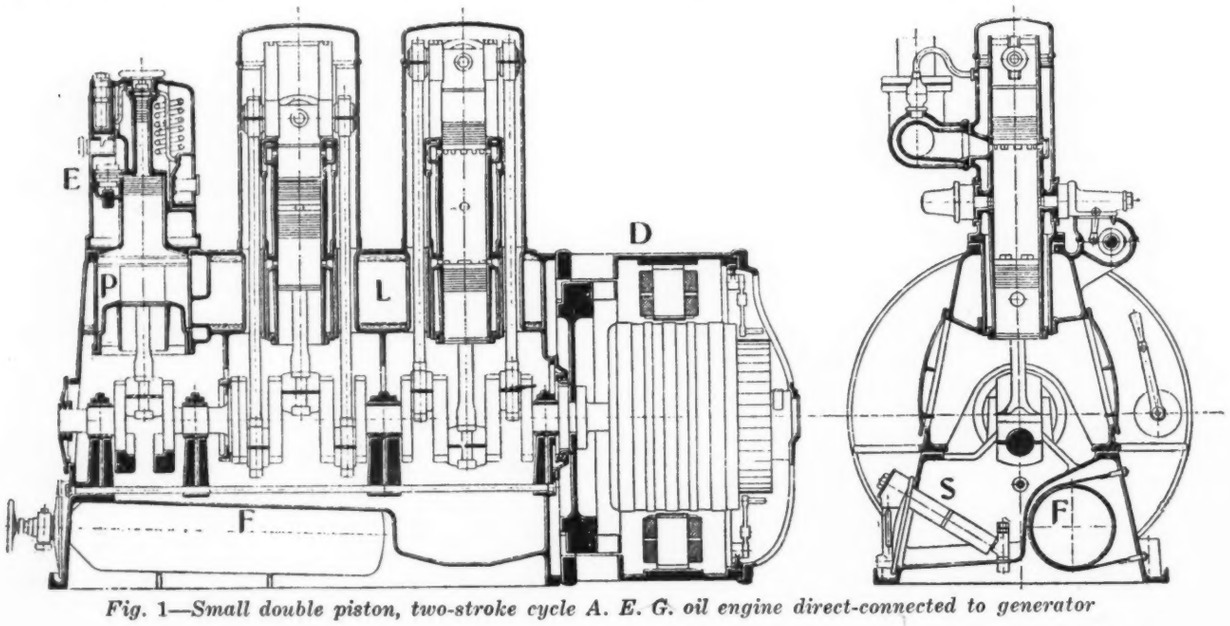


Fig. 1—Small double piston, two-stroke cycle A. E. G. oil engine direct-connected to generator

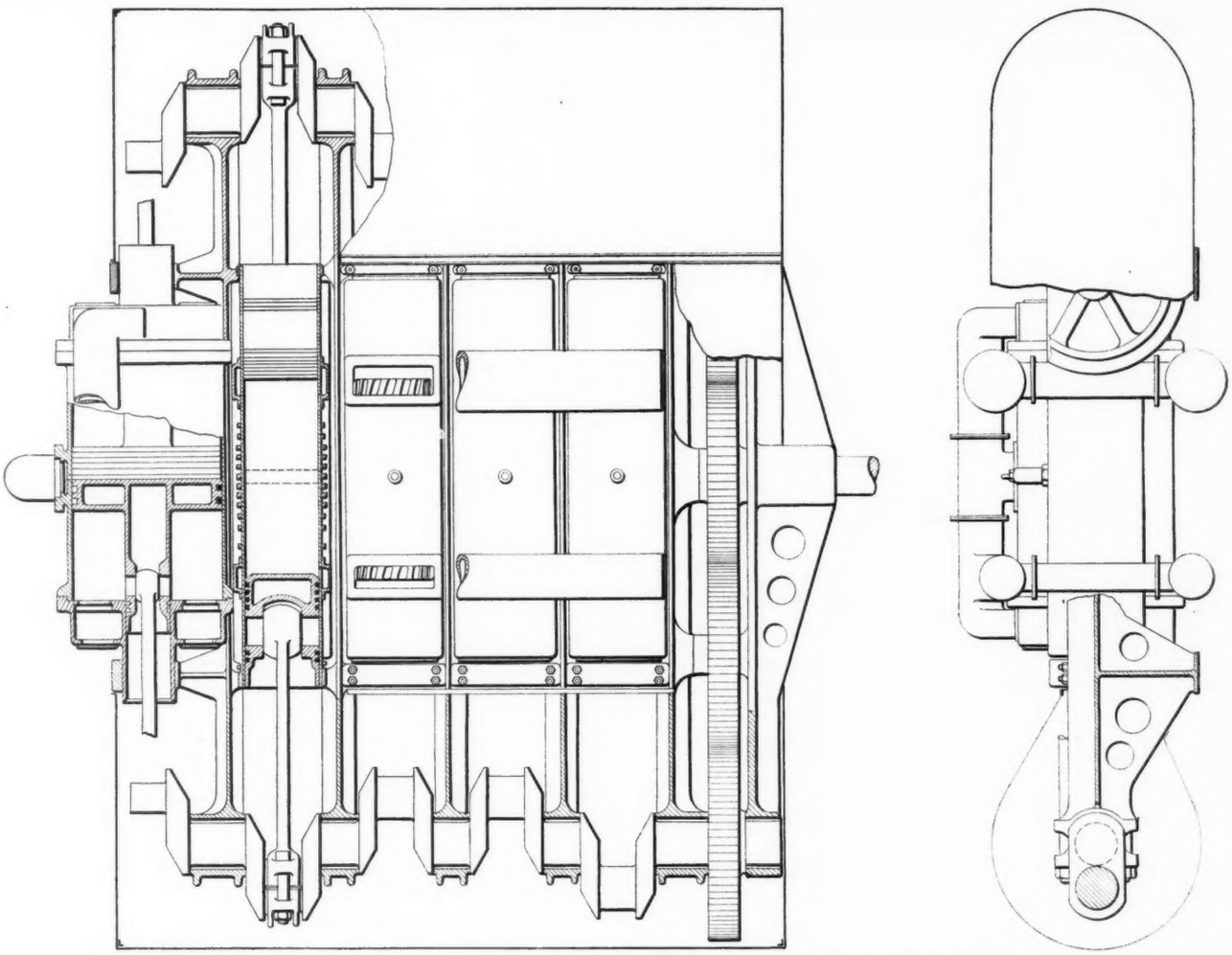


Fig. 2—Junkers aeronautic four-cylinder two-piston engine, with cranks at opposite ends geared together

and the flame propagation is much slower than in the case of a readily volatilized vapor mixed with air. Further, as the compression used is increased the resistance to passage of the spark is decreased, owing to the increased density of the air.

Injection and Ignition

The alternative is to use purely mechanical means for dividing and mixing the oil with the charge of air. In the Diesel engine this mixing is successfully accomplished by using highly compressed air, delivered by a compressor attached either to the engine or driven separately, to blow the oil into the cylinder at the moment when combustion is desired. The pressure in the cylinder is from 400 to 700 lb. per sq. in. and that of the injection of air is from 50 to 100 per cent higher. The proper quantity of oil for one cycle is delivered to the fuel valve during each stroke and at the right moment is forced by this air pressure through passages and holes of various shapes and sizes into the cylinder. A certain amount of the air escapes from the valve with the oil.

This method has one great advantage. The oil and the air, under a pressure considerably higher than that in the cylinder, become thoroughly mixed during the passage through the valve, so that when the pressure is suddenly decreased, say from 800 lb. in the valve to 500 lb. in the cylinder, the oil, already well divided, is subjected to a violent explosive action that tears the small drops apart and produces a finer division, thus rendering the fuel readily combustible. Further, combustion is readily started because each particle of fuel is provided initially with a small amount of air in close contact with it.

This system has several disadvantages. An air compressor is an unwelcome piece of apparatus, doubly so for high pressures and for high speeds; and is not to be thought of for speeds required for automotive engines. When the pressure is suddenly decreased on the entrance of the injection air into the cylinder, the expansion causes a decided refrigerating action upon this air, which is in closest contact with the oil. This action will actually prevent combustion when too much air escapes through the valve. From 5 to 10 per cent of the indicated horsepower is required for the operation of the air compressor. Therefore, although producing an excellent spray, air injection cannot be considered for high-speed engines required in most automotive applications.

Surface ignition engines, at least the smaller sizes, have no air compressor, but inject the oil directly under pressure ranging from 1000 to 3000 lb. or more per square inch. In nearly all designs the oil is forced through an extremely small hole, a few thousandths of an inch in diameter. This gives a fairly good spray, but not one so finely divided that the fuel burns when brought into contact with air at temperatures resulting from the compression pressures used. Further, such sprays are subject to "dripping," that is, the formation of drops of appreciable size before or after injection, or often in the spray itself. This causes excessive carbonization and poor combustion. Therefore, hot surfaces are introduced into the cylinder and the oil allowed to impinge upon or pass near these surfaces. This causes a partial distillation of the oil and furnishes the additional heat necessary for combustion. These conditions tend toward operation on the Otto cycle and the compression pressures, therefore, are kept relatively low to avoid excessive end pressures.

The "direct-injection" system has many merits. With it the air compressor is eliminated, thereby doing away with an expensive and troublesome piece of apparatus and saving 5 to 10 per cent of the indicated horsepower. This saving is

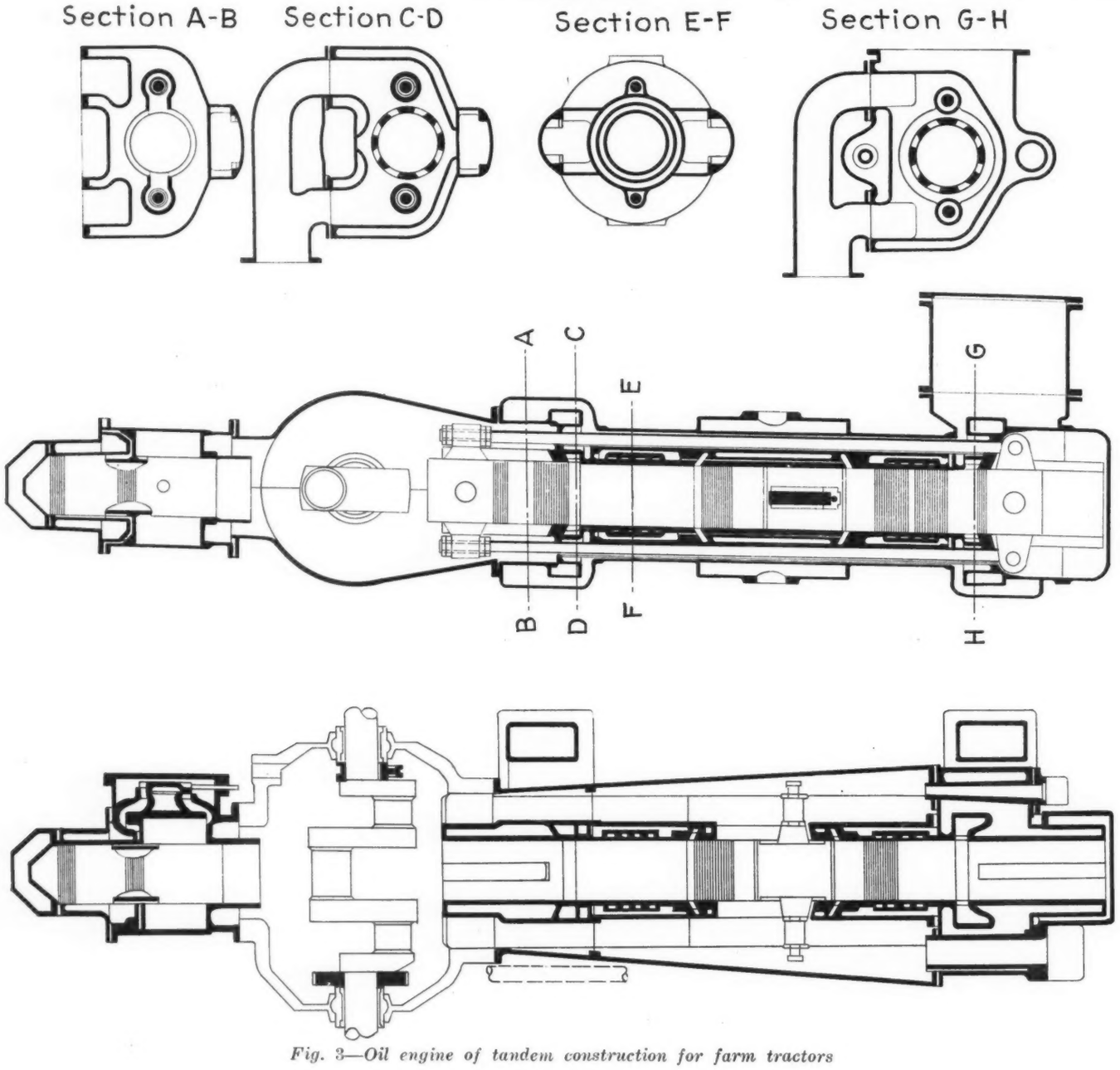


Fig. 3—Oil engine of tandem construction for farm tractors

net because a high-pressure oil-pump is required whether there is an air compressor or not. The system eliminates the refrigerating action of the compressed air. So far it has had the serious drawback that the fuel spray produced does not burn nearly so well as the "air injection" spray, but in this respect some real improvements are being made and practical success is being obtained.

We must work along the line of direct injection in order to develop the heavy oil burning engine for automotive purposes. Enough progress has been made to assure us that it can be done without great difficulty. The author has observed a successful test of an oil pump pumping benzine at 450 atm. (6390 lb. per sq. in.) at about 800 r.p.m. A more recent development has operated well at 7000 lb. and 1150 r.p.m. High pressure in the oil pump at high speed is an essential requirement for successful direct injection.

Assuming that we can succeed in this mechanical mixing of oil and air, we must next devise a means for igniting the mixture. This can be accomplished either by compressing the air to such an extent that the temperature attained will cause ignition, or by permitting parts of the combustion chamber to reach such a temperature that action similar to that in surface ignition engines occurs. The two methods may be combined, in which case the results are the best. If hot surfaces are used, care must be taken not to allow the incoming air to flow over them, since this will have the same disadvantages as heating the air in the carbureter, namely, reducing its density. Most of the heat necessary under these conditions should be secured from the air. The attempt to burn a heavy oil by mechanical injection into highly compressed air makes the time element of combustion important; much more so than with engines in which the fuel is to a certain extent vaporized and is more intimately mixed with the air, so that combustion is virtually instantaneous, or explosive when the mixture is ignited by an electric spark. This means that the speed of mechanical injection engines must, at least at the beginning of their development, be slower than is customary with present gasoline engines, because the burning of oil under the conditions of direct injection is slow as compared to the burning of gasoline vapor in air.

It is well to speak here of the distinction between the explosion and the combustion engine, as engines burning heavy oils are essentially of the combustion and not of the

explosion type. All engines intended to burn the lighter hydrocarbons are, from the nature of the fuel, most easily designed to operate on the Otto cycle. The fuel volatilizes readily and can be drawn into the cylinder with the air and compressed, provided the compression pressure is not too high, and the mixture then ignited. The rise in pressure due to the chemical reaction is almost instantaneous and is the so-called constant volume, or explosive, combustion.

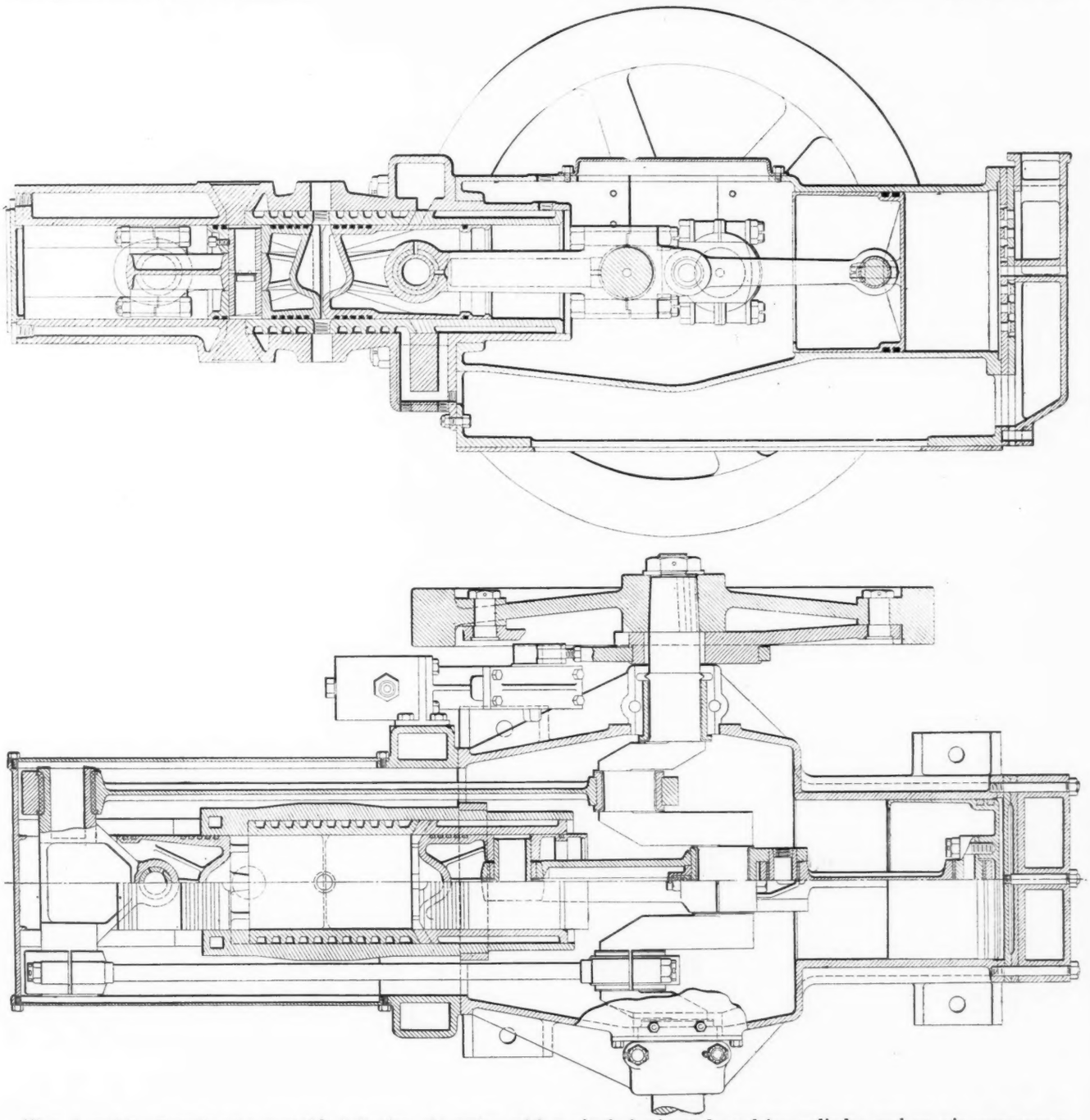
The heavier oils, however, will not mix so intimately with air, and the heat of the air must be relied upon to a great extent to aid in the union of the fuel and the oxygen; consequently combustion is never so rapid, but approaches the constant pressure conditions found in the Diesel cycle. A mechanical condition prohibiting the use of the Otto cycle for heavy oil engines of the proposed type is that the comparatively high compression pressure necessary would produce prohibitive explosion pressures.

The development of direct injection in large engines has conclusively proved that heavy oils, even residues, can be sufficiently finely atomized by mechanical means to burn successfully with compressions as low as 250 lb. per sq. in., provided the combustion space is allowed to remain warmer than in ordinary practice. Direct injection has proved far more successful in small than in large sizes.

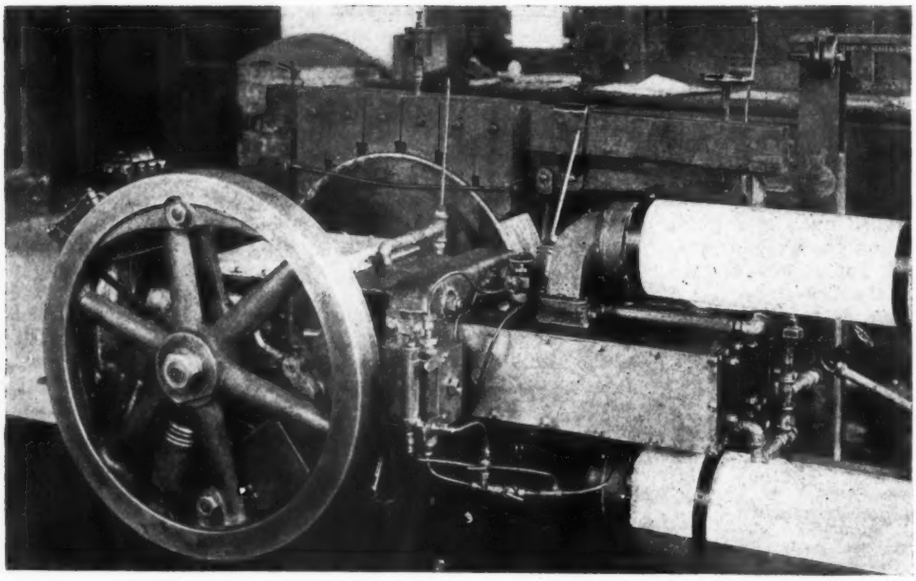
The author has experimented with a spray nozzle which in its present design will atomize a 28-deg. Baumé oil finely enough for the particles to remain suspended in the air for ten minutes. Such a mixture will ignite explosively upon the application of a match flame, which is a small and localized source of heat.

Bearing the foregoing considerations in mind, we see that the design of injection engines will differ radically from that of the usual type of gasoline engine.

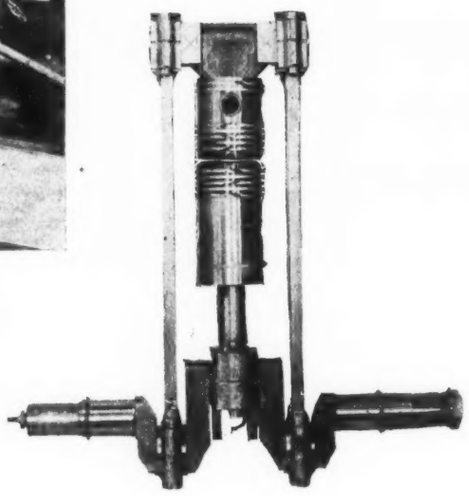
In the first place, the engines will be of considerably slower



Figs. 4 and 5—Details of a portable injection oil engine with a single horizontal working cylinder and an air compressor cylinder on the opposite side of the crankshaft



On left: Fig. 6—Photographic view of the engine illustrated in Figs. 5 and 6. Below: Fig. 9—Pistons, connecting rods and crank in the firing position



rotative speed than is possible with gasoline engines. With better design we can secure higher speeds, but satisfactory operation at 1000 r.p.m. would now be considered a creditable attainment. We must, therefore, for the present make up our minds to use slower speeds. The slower speed engine will naturally be larger and heavier than the gasoline engine to which we are accustomed, particularly when operating on the four-stroke cycle; but we must remember that the first gasoline engines were truly clumsy affairs when compared with present designs. The engines will not need to be much heavier for strength to carry the high compressions because the maximum pressure will not be much greater, although the mean effective pressures will be higher. But the cylinder and piston design will be more difficult, since the mean temperatures will be considerably higher. Because of the slower speed and probable increase in size and weight there will doubtless be a reversion at first to engines with larger and fewer cylinders. It will probably be more economical to build two-cylinder than four-cylinder engines of this type. Further, a small cylinder for an engine of this type requires such a small quantity of oil that the fuel pump design and governing are difficult.

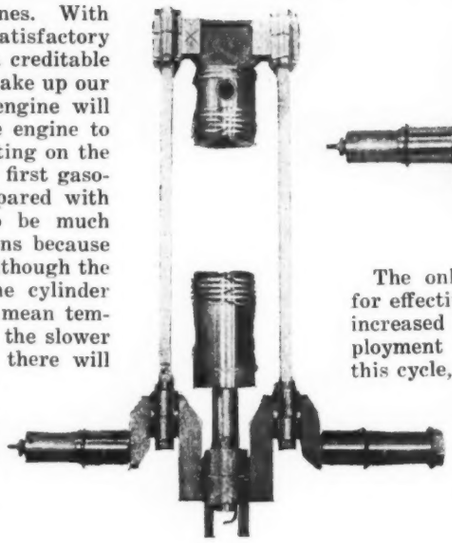


Fig. 8—Pistons, connecting-rods and crank, showing great length of stroke

The only means available at present for effectively combating the tendency to increased size and weight is in the employment of the two-stroke cycle, and this cycle, therefore, should be developed. The author is convinced that success can be obtained in this way by the employment of the double-piston principle, details of which will be discussed later.

The general advantages of heavy-oil engines for automotive purposes can be summed up as follows:

They will be simple in construction, since the spark-plug, magneto and carbureter will be dispensed with, these being replaced by fuel pump and valve, less complicated and more reliable elements.

They will burn much cheaper fuels and will have a much lower fuel consumption than the present gasoline engines.

The consumption of gasoline engines varies from 0.5 to 1.5 lb. per b.hp. per hr. or higher, depending upon such factors as the compression ratio, quality of carburetion and load. If we take the average gasoline consumption as 1 lb. (airplane engines not considered) and the cost of gasoline as 25 cents per gallon, the fuel cost is 3½ cents per b.h.p. per hr. High-speed Diesel engines have burned from 0.45 to 0.7 lb. per b.hp. hr. of fuel. Six-tenths of a pound may be taken as an average. At a fuel cost of 7 cents per gallon this is equivalent to 0.6 cent per b.hp. hr. for fuel to operate such engine, or about one-sixth that for the gasoline engine. On this basis it would seem to be a necessary step in the conservation of our natural resources to encourage the development of the heavy-fuel type of engine.

Injection engines will be as flexible or more so than gasoline engines, and more economical at reduced load and speed, since the high compressions advisable for normal speed will insure compressions at low speed always well above the burn-

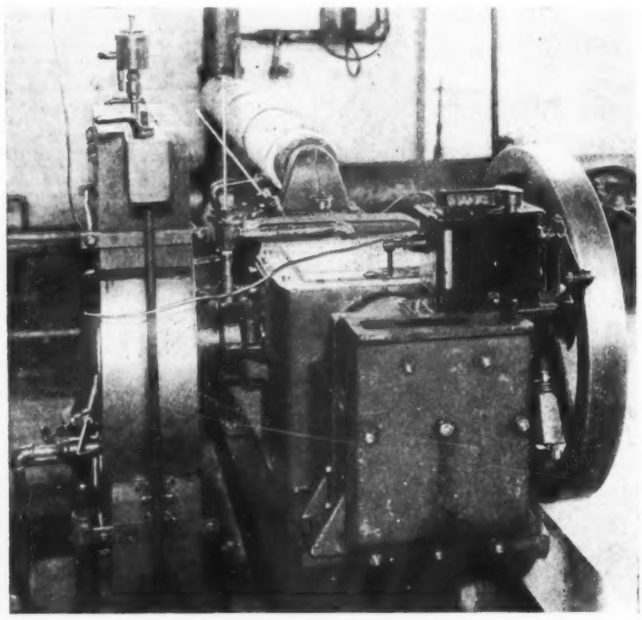


Fig. 7—Another view of the engine

ing point of the oil, and since the trouble arising from changes in the efficiency of the carbureter at varying speed due to the varying suction will be entirely eliminated. The characteristics of the fuel injection depends on the shape of the cam for driving the pump and is constant for all speeds. There is a well-authenticated report of a single-cylinder engine of the injection type in this country which has run at speeds from 160 to 1600 r.p.m., a truly creditable performance.

Such engines will have the disadvantage of larger size and weight in their initial development stages, and cylinder and piston trouble and lubrication difficulties will probably be experienced, owing to the much more severe heat conditions. Further, some time will undoubtedly be required to educate the public to such a radical change in the type of motive power. However, the design of the heavy-oil engine represents a simpler and far more exact problem than that of the gasoline engine, and this should make rapid development possible.

The author has been experimenting recently with an injection engine of which the general arrangement is shown by the Figs. 1 to 6 inclusive.

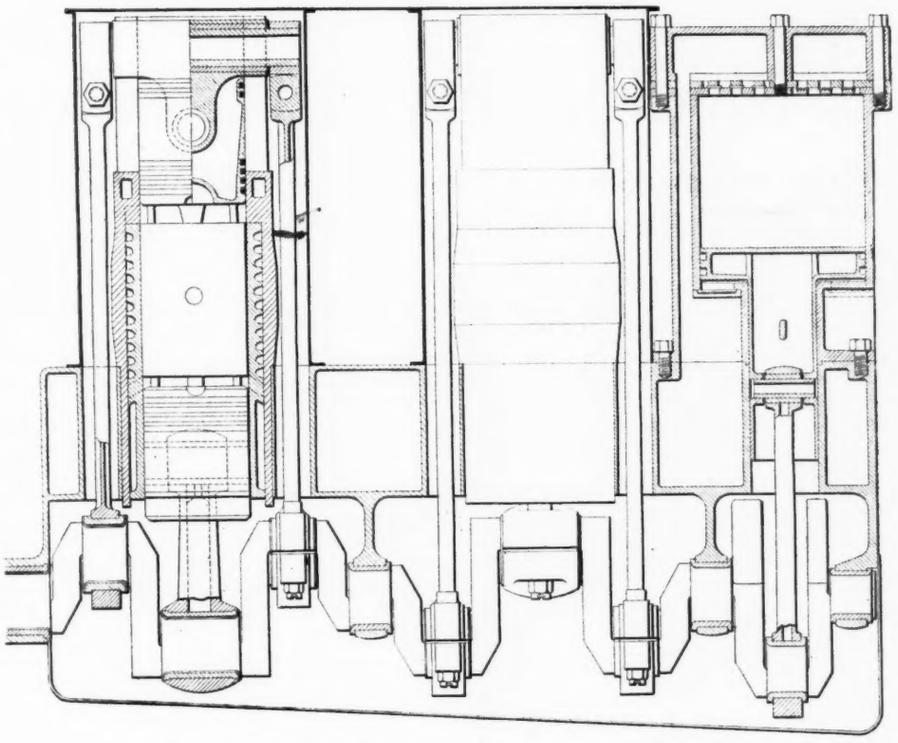


Fig. 10—A two-cylinder vertical type of portable engine

This engine was designed along lines which were known to have been proved successful in other engines. The next step in the development is shown in Fig. 10.

From data already at hand, combustion at high speed in such a construction is known to be possible.

The present engine has but a single cylinder, 5-in. bore, 10-in. stroke, and is expected to develop 40 hp. at 700 r.p.m. It is 55 in. over all and 22 in. wide over the crankcase, or 31 in. over flywheel and driving gear.

By comparing the figures showing the piston at inner and outer dead center (Figs. 8 and 9) the long stroke compared to the short crank is readily noted.

The vertical construction shown has two cylinders of 4-in. bore and 6-in. stroke, and will develop 35 hp. at 800 r.p.m., or 44 hp. at 1000 r.p.m.

These figures are for compressions of 700 lb. per sq. in. and 115 lb. per sq. in. brake mean effective pressures.

The vertical-type construction is 28 in. long, 24 in. high and 10 in. through the engine.

Both these engines can be built to carry 50 per cent overload.

The present engine has, at the time of this writing, been on the test block a week, and has performed as follows: Starting on first trial on fuel oil, 600 r.p.m. on fuel oil and 700 r.p.m. on kerosene, with ability to go faster, 13 hp. at 400 r.p.m., and an hour's continuous run without trouble.

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Rolling Resistance of Tractor Wheels

By E. F. Norelins, M. E.

THIS is written as a discussion on the article by Amos F. Moyer, published in the May 16 issue of AUTOMOTIVE INDUSTRIES.

The writer has not had an opportunity to study in detail the various formulæ which Mr. Moyer has derived, showing the relation between the wheel functions. The relations of these functions, brought out are very interesting, as brought out by actual tests and theoretical formulæ, however, are very interesting.

Without doubt, work of this kind will be of considerable value in enabling tractor engineers to compare results obtained with different methods of drive, without actually making field tests. Of course, it is understood that in order to get the correct foundation for this theory, it would also be necessary to make some preliminary tests. With a proper foundation, however, it would be possible to develop the relation between different functions so that engineers would be able to make valuable use of them.

In connection with the derivation of the relation between these functions, there is a quite different method of analyzing the forces involved. Referring to Fig. 1 of Mr. Moyer's article and using the same letters representing certain functions, it may be assumed that the ground pressure under the wheel must be normal at all times to the surface of the wheel, and that the bearing value of the soil n is proportional to the depression of the soil. To make the problem clear, we will fill the half segment surrounded by the lines a and b and the circular portion of the wheel with a liquid, whose density per cubic inch equals n, which is the same as the bearing value of the soil referred to above. This liquid will produce pressures on the inside of the rim exactly equivalent to the exterior pressures under the assumption of ground conditions that were made in Mr. Moyer's article. And, therefore, all forces which previously were transmitted from the ground to the rim of the wheel will be balanced by the interior pressures caused by this liquid. The value of P would now be equal to the horizontal components of the pressure of the liquid on the rim which is equal to the pressure of liquid on the element d. The unit pressure at the lowest point of the wheel equals dn, therefore,

$$P = \tfrac{1}{2}\, d^2 Fn \quad (1)$$

The weight supported by the wheel rim is equal to the weight of the liquid which has been put into the rim, or,

$$W = AFn \quad (2)$$

where A represents the area of the half segment of the circle below the ground which was filled with the liquid.

In equations (1) and (2) we have values for P and W. The value of P agrees with equation (6) by Mr. Moyer, which, as far as the wheel is concerned, is dependent upon the depth of depression and the face, and, as can readily be seen, is correct, as the work that is done with a certain depth of depression of the wheel and ground conditions, is dependent entirely upon speed of motion ahead. From the above, a value of G, the equivalent grade, can be determined:

$$G = P/W = d^2/2A \quad (3)$$

The above gives a very interesting analogy and a very simple method of analyzing the various forces and functions in wheel resistance.

Medical Problems of Air Service

The Human System Cannot Adjust Itself Rapidly Enough to Change in Atmospheric Conditions During Swift Climb

IT is rapidly being realized that there is a distinct need for the establishment and maintenance of a special department of the medical service for the aviation branches of the armies of the allies. This need develops from the fact that there is a set of medical problems involved in aviation work distinctly different from those of the other branches of the service and that these problems extend into branches of physiology not commonly investigated by the average army medical man.

The physiological problems which are to a large extent, if not absolutely, peculiar to aviation work are those which result from the rapid changes in barometric pressure to which the aviator is subjected, the special demand for clear and accurate vision and the nervous strain created from the conditions under which he does his work.

In an address before the British Parliament recently Sir Watson Cheyne, dealing with the medical aspects of aviation, pointed out that the human being was constructed to live upon the earth, and his mechanisms are consequently adjusted and linked together for living under conditions as they exist on terra firma. He was not built with the idea that he should live in the water or very high up in the air.

In high altitude flying two important conditions differ from those encountered at low altitudes. They are the differences in atmospheric pressure and in the density of the air. The latter is especially important, as with the decreased density the proper amount of oxygen is not available.

Rapid Change in Atmospheric Conditions

While it is possible for people to live at sea level or 5000 or 6000 ft. above it and to go from one altitude to the other without great discomfort when the transition is not too rapid, the aviator with the fast climbing planes of to-day reaches two or three times these heights within a few minutes after having left the earth. Mountain climbers spend a day or two in reaching a height of 10,000 ft. and the human mechanism has time to adjust itself in those cases to the changing conditions.

As the aviator mounts he comes into air that does not contain as much oxygen as is necessary and in order to take in a sufficient amount he begins to breathe faster and his heart beats quicker. In some cases, at a considerable height, the heart will fail, the man will lose consciousness and may actually faint. This fainting may not in itself be fatal, but it is possible, of course, that the aviator may not recover consciousness until it is too late to regain control of his machine.

To counteract the lack of oxygen in the rarefied air, aviators are now provided with oxygen for inhalation. There is found to be a decided difference in the heights to which they go before they are required to make use of the oxygen supply.

The average length of flying life of the army aviator is very short owing to the large percentage of invaliding through loss of flying nerve. Flyers are exposed to a severe strain which comes from many sources and affects most of the senses in ways which are different from those with which in normal life they have become more or less accustomed. Furthermore, the aviator experiences a most intense loneliness when flying over the enemy's lines at high altitude, and this feeling is even worse when flying over the sea.

Other causes of nervous strain are the extra work made necessary by the fact that spells of fine flying weather must be used to the greatest advantage, and the constant strain caused by the anti-aircraft guns of friend as well as foe.

It has been found that when as a result of these and other causes a pilot develops a tendency to estimate his chances and to lose confidence in the powers of himself and his machine he should be given a leave of absence, and it is quite necessary that this leave should be given before there are signs of insomnia and tremor, or otherwise the aviator may never fully recover so that he will again be fit for flying work.

The virtues of chewing gum as a nerve stabilizer are commended by one authority who holds that, while aviators are mostly temperate in the use of alcohol, they smoke altogether too much, especially cigarettes, and he therefore feels that gum chewing should be more widely encouraged.

The tragic side of over-straining the nervous system through continuous high-pressure aviation work was shown by W. F. Bradley, Paris correspondent of AUTOMOTIVE INDUSTRIES, in the second installment of the life story of Captain Georges Guynemer which appeared in the June 6 issue of AUTOMOTIVE INDUSTRIES. The approach of the end of the career of France's greatest ace was indicated in the following paragraph: "Persistent ill luck followed Guynemer during the last few weeks of his life. After bringing down fifty-one machines he was recommended to retire and occupy himself with the construction of airplanes. Further, the doctors stated that he was wearing out his nervous system, and counseled a complete rest. But the fever of activity burned within him to such an extent that not only did he refuse to go to the rear, but he declined the opportunity given him to rest for a while. Shortly afterward he went out alone one day and never returned."

Air service, besides developing the physiological problems due to rapid barometric changes and nervous strain, also brings out unique problems of vision, and these problems form the basis of some of the strongest arguments in favor of the establishment of a distinct medical branch for the aviation forces. It is essential that the vision of the aviator should be investigated by methods which, although well known to experts, are so technical in character that the average medical man cannot avail himself of them.

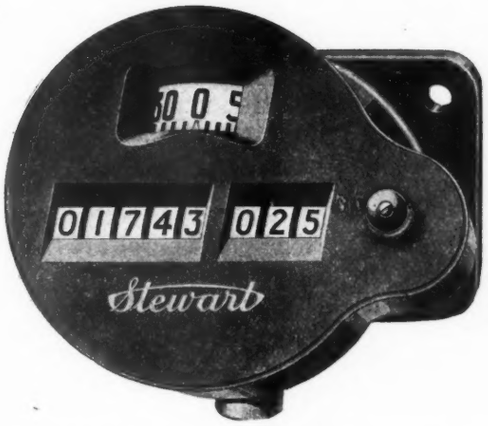
Problems of Vision

As the British *Medical Journal* points out, many authorities have given us "much information respecting the differing sensitivities to various stimuli of the foveal and extra-foveal retina. The Purkinje phenomenon is a familiar example, as is its development into the complex phases of so-called recurrent vision. The special responsiveness of the extra-foveal retina to stimuli of feeble intensity and its relation to the perception of moving stimuli render the activity of this part of the visual field extraordinarily important for estimating movement and for vision under feeble intensities of light. The rare but well-defined condition of night blindness exhibits the disadvantages of pure foveal vision to an extreme degree."

All of this pertains to a branch of pure physiology upon the use of which many lives and the results of important military operations may depend.

In selecting airplane pilots it is quite necessary to determine whether they have true binocular vision, which is most important, especially in flying at high speed and for the rapid connection of sight and action. It is often discovered that one eye is not used at all. The man with this deficiency should not be permitted to enter the air service as a flyer.

It is felt by the advocates of a separate aviation medical department that the medical man of this branch of the service should stand in about the same relationship to the aviator as the trainer does to the athlete. He should have the authority to say whether or not a man should fly at any particular time and to determine when the man should be given leave. The average army medical officer is not considered to be qualified for such responsibilities.



New Stewart Products

SEVERAL new products have recently been announced by the Stewart-Warner Speedometer Corp., Chicago, of which an industrial model vacuum system and a truck speedometer are of particular interest to engineers and manufacturers.

The industrial model vacuum system, known as Model 146-A, has a heavier tank and is built stronger than the previous models. It is specially designed for use on trucks and tractors and with stationary engines. The capacity is much larger and the flow of gasoline is faster. This new model is made in two sizes, one with a round shell of 3¾ pints capacity and the other with a D shaped shell of 5 pints capacity.

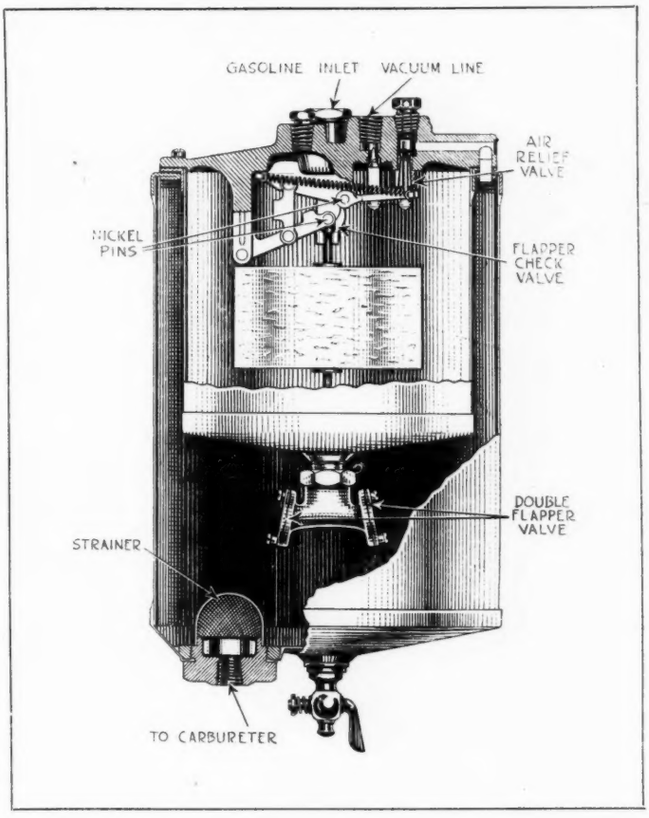
This model has a flapper check valve in the gasoline line at the top of the tank which prevents the gasoline from flowing back when the suction ceases. This keeps the gasoline line always full, so that the instant the float chamber empties the filling process begins.

The air vent is made of the Venturi type to insure rapid emptying of the inner chamber into the lower chamber. The inner chamber has a double flapper valve which allows this chamber to be emptied in half the time that would be required with a single flapper valve.

A cork float is used in this model. The cork is heavily coated with Acco coating to prevent it from getting loaded with gasoline.

A removable strainer in the gasoline outlet leading to the carbureter catches any sendiment in the gasoline and keeps it out of the carbureter. The tank is supplied with a petcock at the bottom to draw off gasoline for cleaning and priming purposes, or water which may have gotten into the gasoline.

The Stewart Model 131-M truck speedometer was designed for Government use, the object in view being to produce a speedometer which would withstand the severe jolts and vibration to which the instrument is subjected on a truck. It consists of a Model 131 speedometer enclosed in an aluminum shell which takes up the jolts and shocks when driving and protects the instrument from breakage due to carelessness in loading, etc.

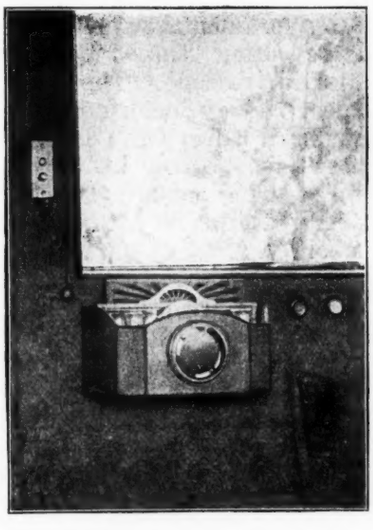


The instrument has a 30-mile rotating speed dial, a 100,000-mile season and a 100-mile trip register, with a reset knob set parallel to the face. The face of the instrument is set at an angle, which makes the figures very easy to read from the driver's seat. Model 131-M is attached to the dash by four wood screws.

Vanity Case Type of Dictograph

THE General Acoustic Co., New York, for a period of a little over a year has been manufacturing an instrument enabling the occupants of a closed car to readily communicate with the driver. A new type of this device, known as the vanity case type, has just been brought out. All that is visible inside the car is a small transmitter plate and two push buttons. One button operates the buzzer which notifies the driver; the other button is depressed while talking. As soon as the pressure on this button is released, the circuit of the dictograph is opened and the driver cannot hear anything that may be said inside the rear compartment.

There is nothing to be put to the mouth while talking. One simply talks in a natural tone and from a natural position toward the transmitter plate, and the sound reaches the chauffeur without any action on his part. The Packard company of Detroit installed a dictograph in a special way, drawing the upholstery over the transmitter plate, so that all that is visible is four small openings corresponding to the openings in the plate. We understand, however, that practically all of the bodies which are being built locally for the Packard company of New York are fitted with the vanity case type.



The Motor Dictograph and its appearance when installed in an automobile's vanity case

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Labor Turnover

AS a result of our present abnormal industrial activity the demand for factory labor is far greater than the supply. Workmen are well aware of this condition, and they often "throw up their jobs" for what seem trivial reasons. The "Men Wanted" sign is up at nearly every factory employment office and the newspaper advertising columns are full of "Help Wanted" ads, so they know they will have no difficulty in securing employment elsewhere. Moreover, as many concerns are making every effort to draw labor from other plants, it is no wonder that factories where the working and other conditions are unpleasant are losing men as fast as they can hire them and have an amazing "turnover."

One of the reasons why workmen often leave the crowded war-industry centers is lack of proper housing facilities. On a recent occasion when the subject was discussed a manufacturer remarked that most of the beds in workmen's boarding houses in his neighborhood had to serve for double shifts, and another said he could go one better in that he knew of a case where a rooming house with eight rooms accommodated ninety men. Men may bear up with such conditions for a while, but they soon tire of them and look for a chance somewhere else.

There has recently been a remarkable increase in the interest in welfare work, which is directly related to the subject of "turnover." This welfare work is aimed at making the working conditions so agreeable to the workman as to tie him to his job. It seeks to protect the health of the men while at work in the factory by providing proper safeguards. It also aims to look out for the well-being of the men during their hours of freedom, by providing suitable housing accommodations and opportunities for wholesome entertainment. It seeks to protect the families of employees by encouraging the formation of benefit associations and protecting the men against loan sharks.

In the past such extensive welfare programs have been carried out only by a small number of very large firms and they have been generally looked upon either as a form of advertising, a form of philanthropy or both combined. It seems, however, that we are rapidly reaching a point where every large industrial employer will have to resort to this means in order to keep his turnover within bounds. A large turnover means operating at low efficiency, because it means operating largely with green hands all the time. In many of the old-established plants the working force divides into two distinct groups—those who have been definitely bound to the firm and who stick in spite of tempting offers from outside, and the floaters.

Catering to the New Demand

ONE of the great lessons which we Americans shall learn from the war is the lesson of economy, of "carefulness in outlay," of "freedom from extravagance" as the word is defined in the dictionaries. We shall gradually, in fact we are already, unconsciously acquiring habits of thrift. We are beginning to realize that it is as necessary to save our material resources as it is to save our money. We are beginning to appreciate what waste means and how the wasteful methods and practices of ourselves and others increase the burden which we help to bear.

Extravagance is rapidly becoming old fashioned—out of date. We are giving more and more thought to getting what we should for what we pay. We are acquiring, without realizing it, an abhorrence for wastefulness and inefficiency.

This new point of view, this changed attitude of the American public, will modify all its actions and activities. Buyers will be governed by new considerations. They will not go about with yard-sticks of efficiency nor measure up their purchases according to definite standards of economy. They will not, as a matter of fact, realize that they are buying in a manner differing from the way in which they formerly bought. But the seller must know that they

are. He must adapt his methods and his merchandise to the new demand.

Automobile manufacturers will do well to consider now how this changed buying attitude is going to affect them, how they must meet it with altered products and with modified selling policies. Many, as we know, are already taking it into account in planning their post-war program. More must do so, and eventually will.

The Call for Efficiency

The demand for economy and efficiency in operation will become stronger day by day and will be one of the chief considerations of the designer of post-war models. Buyers will be interested more in miles per gallon than in body lines and as much so in miles per dollar of tire expense as in hill-climbing abilities. They will inquire more deeply into replacement cost and will more carefully consider depreciation. They will exercise that "carefulness in outlay" which is true economy.

But this does not mean that the demand will be only for low-priced, light-weight cars. In fact, neither price nor weight has more than an indirect bearing on the matter. The inefficient low-priced, light-weight car will be no more popular than the inefficient high-priced heavy vehicle. There will always be a demand for the qualities which the "big car" has. But those who seek these qualities will choose them where they find them accompanied by the more desirable quality of efficiency. For this class of buyers luxury and economy must be brought together.

No Restrictions on Truck Manufacturers

AT the recent convention of the American Drop Forge Association at Buffalo, T. C. Powell of the U. S. Railroad Administration appeared as a representative of the Priorities Board to explain the present system of priority rulings.

This is naturally a most important matter to the drop forge concerns, as all of their product is subject to priority ratings. Probably the most important statement made by Mr. Powell, from the automotive standpoint, is that motor trucks intended for other than military purposes are regarded as essentials by the government, and their production will not be interfered with. This, of course, does not mean that materials, fuels, etc., used in motor truck manufacture will not be subject to government control, but it does mean evidently that in establishing priority ratings, motor truck manufacturers will be fully taken care of.

The statement referred to was made in direct reply to a question by a manufacturer of gears for motor vehicles, tractors, etc., and should be reassuring to truck manufacturers, some of whom, we understand, have been in dread of a cutting off of their supplies by the Priorities Board. In view of the urgent need for transportation facilities and the great services that are being rendered by motor trucks in transporting essential materials and commodities, this view of the Priorities Board is a thoroughly sound one.

Industrial Trucks in Manufacturing Plants

SOME ten years ago it dawned upon the dockmaster of one of the large transatlantic lines that muscle power had become too slow and too expensive for handling freight on docks and in consequence an order was given for the first lot of electric industrial trucks ever placed in service. Since that time the industrial truck has almost ousted the hand truck from steamship piers and railroad yards and it is now making its way into manufacturing plants. Electrical energy can be purchased at a couple of cents per kilowatt-hour less than 1 per cent of what has to be paid for human muscular energy, hence the advantage of using electric power wherever possible is obvious. Of course, human labor cannot be entirely dispensed with; but the drudgery can be taken out of the work and labor can be made ever so much more productive.

The great possibilities of the industrial truck have been well shown by its development on steamship piers. The original truck has even been largely succeeded by tractors which haul five or more trailers on which the freight is carried. A start has been made in employing female labor for driving these trucks and coupling up the trailers. If it were not for the use of these electric trucks and tractors the handling of heavy freight would probably be about the last line of work in which female labor would replace male labor. However, operating these electric trucks and hooking on the trailers to the tractors is work well within the physical limitations of woman. All of the necessary safeguards are provided, and the truck or tractor automatically stops if the operator should be thrown from his seat. Operation of the trucks is a very simple matter, and a new driver can be broken in in a day or two, though it is to be expected, of course, that his skill will increase with further experience.

In automobile, truck, tractor and aircraft factories, and especially in those departments where the heavier work is done, overhead cranes or hoists and monorail installations are usually found. The industrial truck covers a field that cannot well be served by the hoist or crane, which latter is limited to the reach of its track. These trucks can be used for transferring material from one department to another and the tractors are also adapted to moving completely assembled vehicles from one department to another, as from the assembly floor to the paint shop.

Not that the use of industrial trucks in automobile plants is an absolutely new idea. Many of our largest plants are using these trucks. However, this application is comparatively new and is in the ascendancy, and now that a large number of new plants are going up for war work and others are being adapted to new uses the subject merits having attention drawn to it.

Latest News of the

Concentrate on Nine Tire Sizes

Remainder to Be Eliminated During 2½-Year Period—Plan Well Received

NEW YORK, July 1—The finally completed program of the War Industries Board to eliminate all but nine standard sizes of pneumatic tires and concentrate on straight-side types, except in two cases, is viewed with nothing but jubilation by both tire manufacturers and tire dealers. The nine sizes which are to be made will provide plenty of variety to equip all sizes and styles of passenger vehicles and also light delivery vehicles.

It is the plan of the War Industries Board gradually to eliminate a great number of odd sizes for which there has been little call and for which substitute sizes and types are readily available. Thus, for example, some 10 sizes in little demand are to be discontinued Nov. 1, 1918; four more will be eliminated Nov. 1, 1919, and nine more on Nov. 1, 1920. There seems no reason why this gradual elimination should impose hardships on either tire makers, tire dealers or the owners of cars. Following are the sizes that are to be continued without change:

Class A

(Plain and non-skid treads)

Size	Rim
30 x 3½	Clincher
32 x 3½	SS
31 x 4	Clincher
33 x 4	SS
34 x 4½	SS
35 x 5	SS
36 x 6	SS
38 x 7	SS
40 x 8	SS

The following sizes are to be discontinued Nov. 1, 1918:

Size	Rim
30 x 3½	SS*
32 x 3½	QD*
32 x 3½	C1*
33 x 4	QD*
33 x 4	C1*
35 x 4	SS*
29 x 4½	SS*
32 x 4½	QD*
33 x 4½	QD*
36 x 4½	QD*
36 x 4½	SS†
34 x 4½	QD*
37 x 4½	SS*

*Non-skid. †Plain tread.

The following sizes are to be discontinued Nov. 1, 1919:

Size	Rim
33 x 4½	SS†
36 x 4½	SS*
35 x 4½	QD*
37 x 5	QD*

*Non-skid. †Plain tread.

The following sizes are to be discontinued Nov. 1, 1920:

Size	Rim
30 x 3	C1*†
32 x 4	SS*†
34 x 4	SS*†
32 x 4½	SS*†
33 x 4½	SS*†
35 x 4½	SS*†
33 x 5	SS*†
35 x 5	QD*
37 x 5	SS*

*Non-skid. †Plain tread.

Although the number of sizes and types to be eliminated is considerable, the list has been carefully worked out and for each size or type done away with there remains one which can be substituted for it. Thus, for example, where a QD size is eliminated a straight side size remains, and this can be used on QD rims by the addition of a bead filler strip. Similarly, where a size has been eliminated in both straight side and QD, it is quite possible to use what heretofore has been termed an oversize.

The effect of the standardization on nine sizes will be to reduce very greatly the machinery required in tire making. Tire makers will be able to concentrate on a few sizes and turn these out in correspondingly greater quantities. The action should operate to eliminate shortages in certain sizes which have become prevalent of late.

On the side of the tire dealer the action is excellent. It permits him to stock only nine standard sizes instead of a much greater number that always has been necessary heretofore. It is estimated that by the time for the elimination of certain sizes car owners will have anticipated to a sufficient extent to permit the change being made without difficulty.

Although nothing specific has been said about it, it is understood that the order is to apply to both fabric and cord tires.

That the move to standardize sizes is quite agreeable to car manufacturers is evidenced by the fact that both the National Automobile Chamber of Commerce and the Society of Automotive Engineers have signified their approval of the plan.

—

White Heads Transport Operations

WASHINGTON, July 2—Walter White of the White Co., Cleveland, has been appointed in charge of operations for the Motor Transport Service under Col. F. Glover. Mr. White takes the place vacated by the transfer of Lieut.-Col. James Furlow to the general staff; he will have charge of the operation of army trucks in this country.

Exports of Gasoline Increase

April Figure 4,500,000 Gal. Ahead of Last April—France Biggest Buyer

NEW YORK, July 2—During the month of April the United States exported four and one-quarter million gallons of gasoline more than it did during April, 1917, and for the 10 months ending April, 1918, as compared with a similar period in 1917, the increase was nearly 25,000,000 gallons. Of the 20,862,303 gallons exported in April, 1918, France received nearly one-third, with the United Kingdom next taking approximately one-fourth, and Canada and Cuba next with about one-seventh each. Following are export statistics for April, 1917 and 1918, and for the 10 months ending April, 1918:

	April, 1918 Gal.	April, 1917 Gal.
France	6,177,093	5,267,106
Italy	1,588,900	4,712,698
Unit. King.	4,527,365	.....
Canada	3,334,560	1,274,684
Panama	54,104	100,950
Mexico	38,658	57,374
Cuba	3,086,913	35,895
Argentina	10,000	598,971
Brazil	111,100	547,850
Uruguay	.....	50,000
Venezuela	157,165	132,452
Australia	148,400	600,750
New Zeal	657,810	1,884,194
Philip. Isl.	.....	100,000
Brit. So. Af.	.....	339,450
Other countries	670,235	901,756
Total	20,862,303	16,604,130

Ten months ended April, 1918-1917:

France	48,646,118	52,056,033
Italy	26,651,703	12,318,071
Unit. King.	56,818,949	48,252,299
Canada	23,207,667	17,525,387
Panama	1,210,309	792,367
Mexico	952,433	449,955
Cuba	6,037,328	1,207,811
Argentina	2,139,586	2,025,294
Brazil	4,666,648	4,658,968
Uruguay	400,020	193,400
Venezuela	436,985	675,337
Australia	6,839,215	6,123,220
New Zeal	6,008,459	5,747,054
Philip. Isl.	1,496,604	2,187,580
Brit. So. Africa	2,414,240	3,081,930
Other countries	9,624,375	15,862,561
Total	197,550,639	173,157,267

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Major Wall Now a Lieutenant-Colonel

WASHINGTON, July 2—Major W. G. Wall, who was chief engineer of the National Motor Vehicle Co., Indianapolis, has been promoted and is now a Lieutenant-Colonel. Col. Wall has just returned from the American Expeditionary Forces in France where he was investigating motor equipment, including tractors and tanks.

Automotive Industries

To Close Washington M.A.M.A. Office

Work to Be Continued by War Service Committee in Charge of A. W. Copland

NEW YORK, July 2—It is altogether likely that the Washington office of the Motor and Accessory Manufacturers' Association will be closed in the near future. At the last meeting of the association a resolution was introduced placing in the hands of manager L. M. Bradley the matter of closing the office, or keeping it open if in his discretion sufficient need for such service remains. Although nothing definite has yet been decided upon it is probable that the office will be closed the end of this week.

The closing of the office will not mean the abandonment of the work which it has been carrying on, however. This is to be continued under the active supervision of A. W. Copland, who is chairman of the association's War Service Committee and who is at present in charge of the Washington office.

The establishment of the Washington office, which is housed in the Ouray Building, was done with the object of assisting members and the government in war work. Since the establishment of Regional Purchasing Departments, however, much of the work done by Mr. Copeland and his assistants now is being done by the government. Furthermore, many of the M. A. M. A. members who were in line for government work have received it, so that the need for the Washington office is passing rapidly.

President Stiger is to call a conference of the War Service Committee of the association for Friday of this week at which future work of the committee will be discussed and decided upon. This meeting is to be held in Detroit.

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Two Lincoln Men Out

DETROIT, July 2—Rex Johnson, production manager, and Glenn Johnson, purchasing agent of the Lincoln Motors Co., have resigned. W. W. Goss, of the Condon-Carpenter Co., Providence, has been appointed in the place of Glenn Johnson.

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Grant Heads Kerosene Equipment Co.

DETROIT, July 1—At a stockholders' meeting of the Kerosene Equipment Co., a Delaware corporation, the following officers were elected: President, George D. Grant, president of the Marx Brass Works, Detroit, and director of the Grant Motor Co., Cleveland; vice-president, J. W. Racklycoft; secretary, R. J. Sherman; treasurer and general manager, E. E. Schwarzkopf. Announcement of the appointment of a sales manager will be made shortly. The officers, with Frederick C. Billings, president of Billings & Spencer, Hartford, Conn., make up the board of directors. The company has started production of its carbureters in its plant at 74 East Fort Street.

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Two Tire Companies Raise Prices

NEW YORK, July 2—Two tire companies, the Lee Tire & Rubber Co., and the Endurance Tire & Rubber Co., have increased prices of their tires beginning July 1. Lee tires are up 5 per cent and Endurance 10 per cent. There does not seem to be a general disposition to raise prices on the part of the other large companies, but one or two have expressed the opinion that increases may be looked for in the near future. The new prices follow:

Size	Old Price	New Price
Lee		
30 x 3	$15.70	$16.50
30 x 3½	20.00	21.00
32 x 3½	23.50	24.70
31 x 4	31.00	32.55
33 x 4	33.05	34.70
34 x 4	34.25	36.00
34 x 4½	45.55	47.85
36 x 4½	48.40	50.85
35 x 5	55.90	58.70
37 x 5	59.15	62.10
Endurance		
30 x 3	$20.35	$22.40
30 x 3½	26.15	28.75
32 x 3½	30.25	33.25
31 x 4	39.90	43.90
33 x 4	42.65	46.90
34 x 4	44.00	48.40
34 x 4½	58.30	64.10
36 x 4½	61.90	68.10
35 x 5	69.85	76.85
37 x 5	74.00	81.40

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Find Emerson Motors Guilty

NEW YORK, July 2—The Emerson Motors Co., Kingston, N. Y., and four of the brokers who sold its stock have been convicted by a jury in the Federal District Court of using the mails to defraud. President George A. Campbell, his son George Campbell, who is treasurer, George B. Gifford, a director, and Will H. Stetson, a promoter, were found not guilty. All of these individuals, as well as the Emerson company, were tried on an indictment of 13 counts, 12 for using the mails to defraud and one for conspiracy.

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Wright-Martin Production 25 a Day

NEW YORK, July 2—The Wright-Martin Airplane Corp. is reported to be producing engines at the rate of 25 a day, this being an increase of 5 a day over the production a month ago. It is expected that the new plant in Long Island City will be ready for operation soon and that production will be brought up to 50 engines a day before the end of the year.

Some Steel in Sight for Cars

Steel Mills Urging Automobile Plants to Contract for Future Deliveries

NEW YORK, July 2—Although the steel situation is still in a more or less unsettled condition, some ray of hope is seen by those who have been watching developments with a discerning eye. Now that the President has approved the agreement made by the Price-Fixing Committee of the War Industries Board with representatives of the iron ore, pig iron and iron and steel interests, an air of comparative quiet reigns; prices are not to be altered until Sept. 30, 1918.

It is still impossible for anyone to know with any degree of accuracy, the quantity of steel that will be required by the government in the filling of war orders, for ships, etc. And though the steel makers are quite frank in their statements regarding the impossibility of making shipments at the present time, it is understood on excellent authority that they are urging automobile makers to engage in contracts for future deliveries.

It is stated that within the next 90 days the government will find that it cannot absorb the entire output of the mills and that it will be forced to permit deliveries to non-war industries in order to obviate the possibility of trouble in the various steel plants.

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Sale of Paige Denied

DETROIT, July 1—The rumor that the General Motors Corp. is about to purchase the Paige-Detroit Motor Car Co. is unfounded according to H. M. Jewett, president of the latter company. The Paige company has been approached a number of times in the past by the General Motors Company with offers to sell and the recent visit to the east of Mr. Jewett who sought an interview with W. C. Durant of the General Motors caused an over-zealous newspaper correspondent to write a story to the effect that Jewett's visit was prompted by a desire to go through with the deal. As a matter of fact, the conference between the two men dealt only with the steel situation.

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Turnbull Sales Handled at Defiance

DEFIANCE, OHIO, June 27—The truck sales division of the Turnbull Motor Truck Co. has been transferred from Fostoria, Ohio, to the factories at Defiance.

Federal Trade Commission Finds Many Companies Made Huge Profits

Fixed Price Plan Helps Swell Dividends—War Work Profiteering Found—Steel Profits Without Precedent—False Reports of Gasoline Shortage Circulated

WASHINGTON, June 29—Large profits are made by low cost concerns under the governmental fixed price for the whole country plan.

The outstanding feature on the score of profit is the trade tendency to increase and maintain prices against the forces of competition.

Considerable profiteering due to the necessities of the Government exists.

Steel profits, due to the Government price fixing, are without precedent.

Reports of gasoline shortage have been circulated for the purpose of maintaining the high prices and heavy profits which gasoline producers are enjoying.

These and other important findings are announced to-day by the Federal Trade Commission in a report to the President of the United States Senate.

The Federal Trade Commission is operating to secure information on the present range of profits in various industries through three activities:

a. Cost finding by the Commission for the War Industries Board, Food Administration, Fuel Administration and other executive departments which have called upon the Commission for this work.

b. Industrial surveys undertaken by the Commission at the direction of the President or upon its own initiative.

c. Enforcement of the law against unfair methods of competition.

Many Industries Reviewed

Under these activities the Commission has had recent view of many industries handling basic materials including steel, copper, zinc, nickel, sulphur, lumber, coal and petroleum and its products. It has also had daily contact with the tendencies of the trade and revealed through numerous complaints filed for the application of remedies under the powers of the Commission.

The outstanding revelation, states the Commission report, which accompanied the work of cost finding, is the heavy profit made by the low cost concerns under a Governmental fixed price for the whole country. The Commission states that it has reason to know that profiteering, due to advantages taken of the necessities of the times as evidenced in the war pressure for heavy production, exists. Some of this profiteering, it is said, is attributable to inordinate greed and bare-faced fraud.

"In the case of basic metals, as in steel, when the Government announced a fixed price, it was made so high that it would insure and stimulate production. This has resulted in giving a wide margin of profits. Under the device of cost plus a margin of profit, these profits are necessarily great in the case of the low cost mills. Thus while the market was prevented from running away, as it would have done undoubtedly if it had not been regulated by a fixed price, the stronger factors in the industry are further strengthened in their position and enriched by profits which are without precedent."

Following is the important part of the text of the Federal Trade Commission report:

"The experience with steel, shows that a high stimulating fixed price, while stabilizing an ascending market, produces an economic situation which is fraught with hardship to the consuming public and with ultimate peril to the high-cost companies through increasing the power of their low-cost competitors.

Petroleum Market Surveyed

"In this connection a survey of the petroleum field shows that the market, when under the control of dominating factors, such as Standard Oil, can be one of huge profits without the device of the high fixed price. No price for the public has been fixed upon petroleum and its products by the Government.

"Unlike the situation in steel, flour and coal, there has been as yet no Government interference with the law of supply and demand except in the instances of Government purchases.

"Under that law large profits may eventuate through the bidding up of prices by anxious buyers. And, moreover, even in the absence of this element, prices may be forced up by spreading false and misleading information concerning the condition of supply and demand.

"Reports, for instance, have been circulated that the supply of gasoline was endangered for the purpose of maintaining the high price of that product and the heavy profits from it. At different stages of the oil industry different products of petroleum have yielded the heavy profits. Kerosene was once the chief profit producer. Gasoline followed and superseded it as the chief producer of profits.

"Enormous profits are now being made in fuel oil, with the advantage to the refiner that the high price of the product meets no popular challenge. Gasoline is maintained at its present high price and procures heavy profits for the low-cost refiners.

"Payment of extraordinary salaries and in some instances bonuses to executives of corporations have been found by the Commission during its investigations. An illuminating example of high remuneration, charged to the expense account, is that given by the American Metal Co., Limited, of New York, the chief dealings of which are in zinc. Appended are the salaries and tantieme (French—an interest, commission of proportional amount) of some of the chief officials.

B. Hochschilf, Chairman of Board of Directors	$179,663.36
C. M. Loeb, President	364,326.73
Otto Sussman, Vice-President	221,596.04
J. Loeb, Vice-President	147,930.69
Sol. Roos, Manager St. Louis office	148,530.69
M. Schott, Manager Denver office	136,553.12

"In addition to the information above given, the Federal Trade Commission occupies an advantageous position where it is possible to view certain tendencies in trade which bear upon the problem of profiteering.

Can Prevent Unfair Methods

"Under the law the Commission has power to prevent unfair methods of competition and it is daily in receipt of complaints which it investigates and, if it has reason to believe that an unfair method has been used, arraigns the party complained against for a hearing of the issue. It has developed that, outside legitimate increases in price due to higher costs and other economic elements, certain members of trade have preyed with avarice upon the consumers.

"Another trade practice has developed in which the consignee refuses goods after shipment because the market has fallen, and vice versa the consignor refuses to ship on a rising market. These instances, which in the knowledge of the Commission have not been numerous, have been handled by the Commission in connection with the Food Administration and its power of revocation of license.

"Still another trade practice which has increased the price of supplies to the consumer has been that of commercial bribery, upon which subject, this body recently addressed the Congress, suggesting remedial legislation.

"Again, the trade tendency of manufacturers maintaining the resale price of wares has contributed to holding high the general price level and in instances has increased profits without question. The action of the courts and the Federal Trade Commission in prohibition of this policy is becoming generally known to the trades and will, in our opinion, work a correction by opening up some of the closed channels of competition.

General Trade Excellent

"In submitting the subjoined memoranda on the industries under consideration, the Commission expresses the opinion that general trade, as the Commission has opportunity to view it, is in a high state of prosperity. With some exceptions that condition has continued for several years past. Many of the industries are making unusual profits, some are showing outrageous ones. In an hour of national service and self-sacrifice, profiteering may be defined not only as the taking of an exorbitant profit, but should include a refusal to share in bearing the burdens of war in the form of a reduction in profits when the profits have been large in pre-war times.

Steel

"In 1917, the steel companies made abnormal profits in the period prior to the Government price fixing policy, and a number have continued to make unusually heavy profits since that policy was inaugurated. In finding costs in this industry for the War Industries Board, the Commission divided the steel makers into four groups:

"(1) The fully integrated mills.

"(2) The mills which start with the manufacture of pig iron.

"(3) The mills that start with steel furnaces.

"(4) The mills that make rolled products from purchased semi-finished steel.

"The United States Steel Corp. is included in Class 10. Its profits expressed in terms of the total amount invested in the business shows net earnings as follows:

1912	4.7%	1915	5.2%
1913	5.7%	1916	15.6%
1914	2.8%	1917	24.9%

"The figures, as to the net income of the Steel Corp. as shown by the company for the years 1912, '13, '14, '15, '16, and '17 before deducting Federal Income and Excess Profits Tax in 1917, follow:

1912	$77,075,217	1915	$97,967,962
1913	105,320,691	1916	294,025,564
1914	46,520,407	1917	478,204,343

"The Federal Income and Excess Profits taxes of the Steel Corp. for 1917 were $233,465,435, which leaves from net income $244,738,908, of which about one-tenth was applicable to interest on bonds of the corporation and the rest available for dividends and surplus.

"From information in possession of the Commission, mills in Class 2 appear to have made heavy profits in 1917. Recently, mills in Class 3 made objection that the Government prices were too low for them. A special examination of their profits by the Federal Trade Commission showed that in almost every case these objecting mills were enjoying unusual returns.

"The following table of percentage of return on investment in ten mills in Class 3 will show the profits in 1917:

	1917 Per Cent
Allan Wood Iron & Steel Co.	52.63
Allegheny Steel Co.	78.92
American Tube & Stamping Co.	40.03
Central Iron & Steel Co.	71.35
Eastern Steel Co.	30.24
Forged Steel Wheel Co.	105.40
Follansbee Bros. Co.	112.48
Nagle Steel Co.	319.67
West Penn Steel Co.	159.01
West Leechburg Steel Co.	109.05

"Mills in Class 4, which buy the semi-finished steel and convert it into the more highly developed steel products, have enjoyed substantial profits.

Copper

"Very large earnings have been made in the copper industry on the whole, although it should be noted that they have been due in part to an unusually heavy demand for this metal, which is used almost exclusively for war purposes directly and indirectly.

"The Commission's figures show that 21 companies, including a large proportion of high-cost companies, made profits in 1917 which ranged from 1 per cent to 107 per cent on their investments. The average profit was 24.4 per cent. Probably over 70 per cent of the production is marketed at profits over 20 per cent on investment.

"These same companies show an average profit of only 11.7 per cent in 1913, which may be considered to be a normal year. Thus the average profit in the industry has more than doubled. The range of profits in 1913 was from 1 to 56 per cent.

"The profits used in these computations do not include Federal income or excess profits taxes, and, therefore, represent sums actually retained by the companies for addition to surplus or dividends.

"There does not appear on the whole to have been any concerted action in this industry in putting prices up in the first instance. The war scramble among the Allies shot the prices of copper and other metals to almost unheard of levels. But there are certain strong interests among the producers and marketers which predominate in certain stages of production, and these appear to have taken steps to maintain prices at unnecessarily high levels.

"In the first place, the smelters, and notably the American Smelting & Refining Co., have continued to hold in force certain deductions for risk of carrying copper bought from mines, which risks have ceased to exist. These deductions were put in force during the early period of the war, before price was fixed by agreement with the War Industries Board.

Their present maintenance amounts to profiteering at the expense of the miners, especially the small producers. On the other hand, some of the larger and richer mines have contracts entered into before the war running for periods as long as 20 years, which are extremely advantageous to them and which are now causing some refineries to operate at a loss.

Zinc

"Most of the evidence in the Commission's possession indicates no unusual profits in the zinc industry, with the exception of the operations of the New Jersey Zinc Co.

"The following net earnings and dividends are shown for the New Jersey Zinc Company according to published statistics; 1916, profits, 72.5 per cent, dividends 76 per cent; 1917, profits 56 per cent, dividends 46 per cent. The Federal Trade Commission's figures as to these same net earnings and dividends are available only for 1916, and indicate profits of 95.9 per cent, with dividends of 76 per cent.

"These large earnings do not indicate excessive profits on metallic zinc. The company's profits on common spelter are very low, and on Grade A spelter while high are due to the fact that it possesses a natural monoply of a certain high grade ore, the product of which cannot sell for less than the zinc produced by competitors. In fact, the whole explanation of the New Jersey Zinc Company's large profits lies in its possession of an ore body of unusual richness and purity.

Petroleum and Its Products

"The data secured by the Federal Trade Commission for 106 refining companies for the first quarter of 1918, supplemented in certain cases by returns for the second six months of 1917, indicate that the average profit in the oil industry is about 21 per cent on the investment.

"This is a considerable increase over the rate of profits indicated for pre-war years, as the Commission's gasoline report indicates an average profit for the years 1913, 1914 and 1915 of 15 per cent on the investment. In 1917 over 50 per cent of the estimated production was produced by companies having a profit of over 20 per cent on the investment. Rates of profits ranged from losses up to 122 per cent.

"The profits of the Eastern refiners have been relatively larger than those on the Pacific Coast. The situation in the East is due to the fact that, while gasoline prices have been but slightly advanced, the prices of other products have been increased greatly, especially the price of fuel oil. The public knows little about prices except the price of gasoline, and to a less extent kerosene. Formerly

(*Continued on page* 41)

Profits of Petroleum Refiners For 4 Years

	1913	1914	1915	First Quarter 1918	‡1918 (Estimated)
Atlantic Refining Co.	16.4	—3.7	21.7	*15.0	30.0+
Standard of Indiana	36.5	14.5	36.0	*21.7	43.3+
Standard of New Jersey	9.7	7.8	20.6	*9.1	18.2+
Standard of New York	21.2	8.1	16.0	*6.6	13.3
Standard of Ohio	23.4	13.8	23.9	*14.3	28.6+
Standard of Kansas	91.6	1.0	17.9	†25.6	51.3+
Magnolia Petroleum Co.	19.2	16.5	14.2	4.4	17.6
Standard of California	16.8	12.5	10.6	6.5	25.9+
Continental Refining Co.	1.6	—7.8	3.3	1.2	4.7+
Empire Oil Works	4.4	—3.1	5.6	17.6	70.4+
Penn American Refining Co.	35.3	13.3	12.3	15.8	63.1+
Cosden & Co.	..	30.6	—50.7	5.9	23.5
Muskogee Refining Co.	8.7	6.9	18.8	6.2	24.8+
National Refining Co.	24.9	8.0	20.4	2.3	9.2
The Texas Company	17.1	13.3	12.7	*13.3	26.7

*Six months period, July-December, 1917.
†Last six months of 1917.
‡Estimate based on figures for last six months of 1917, or first quarter of 1918.

New York Dealers Join N. A. D. A.

More Than 100 Enroll in Growing Organization—Movement Spreading Rapidly

NEW YORK, July 1—More than one hundred dealers of New York, Brooklyn, the Bronx and towns north and east within 100 miles enthusiastically rallied to the support of the growing National Automobile Dealers' Association at a meeting at Reisenweber's this noon. More members were secured than was believed possible. Brooklyn joined its twenty-one members in a body.

At the meeting President F. W. A. Vesper of the National explained in a 45-minute talk the work the association has done and is doing at Washington and elsewhere to safeguard the rights of the dealers and was followed by Executive Secretary E. E. Peake, who told of the need for greater numerical strength.

The 5000-in-90-days membership campaign has started with good results. At a meeting in Pittsburgh Thursday night 208 dealers of that section joined. In Harrisburg Friday night 40 joined. A meeting is being held in Philadelphia this noon at which it is expected the Pittsburgh and New York meetings will be duplicated.

From the East the campaign will move west for a few days with meetings in Cleveland, July 9, Indianapolis, July 10, and Minneapolis, July 12. Later there will be another group of eastern meetings including Newark, N. J., Boston and several New York state cities.

Advices from the N. A. D. A. headquarters in St. Louis state that applications are pouring in from all sections. Meetings and organization plans are being perfected, in addition to the cities mentioned, in Clinton, Iowa; Fort Dodge, Iowa; Des Moines; Joplin, Mo.; Richmond, Va.; Waterloo, Iowa, and San Antonio, Tex.

The war conservation plan worked out by President Vesper and the War Service Committee, a feature of which is the closing of service stations and salesrooms nights, Sundays and holidays, is sweeping the country.

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Fix Acid Prices

WASHINGTON, June 29—Prices for sulphuric and nitric acid have been fixed following conference between the manufacturers and the War Industries Board. The following maximum prices per ton of 2000 lbs. were agreed upon and approved by President Wilson, taking effect at once and expiring Sept. 30, 1918:

Sulphuric Acid—60° Baumé, $18; 66° Baumé, $28; 20 per cent oleum, $32; f.o.b. at makers' works in sellers' tank cars. In carboys in carload lots, ½ cent extra per lb.; in carboys in less than carloads, ¾ cent per lb. extra; in drums, any quantity, ¼ cent per lb. extra.

Nitric Acid—42° Baumé, 8½ cents per lb. f.o.b. makers' works in carboys.

A schedule of maximum prices will be issued later after completion, relative to mixed acids.

The above maximum prices were agreed upon for the public as well as the Government. Deliveries made after Sept. 30 will be subject to any revision in price which the Government makes after that date.

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Automotive Electric Meets July 10-13

NEW YORK, July 1—The semi-annual meeting of the Automotive Electric Association is to be held at the Lake Placid Club, Lake Placid, N. Y., July 10 to 13 inclusive. Aside from routine business the following papers are to be presented: "Standardization in Problems in the Starting and Lighting Industry," by B. M. Leece; "Size and Performance of Batteries in Relation to the Size of Engines for Work to Be Done," by C. F. Gilchrist, chief engineer Electric Autolite Corp., Toledo.

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Regal Sold at Auction

DETROIT, June 28—The machinery, equipment and property of the Regal Motor Car Co. was sold June 26 by the Security Trust Co. acting as receiver for the company. The total assets of the company were listed by the receiver as $1,137,140.82. In this was included some machinery, which was later sold to the Government for $41,000, about 5 per cent in excess of its inventoried worth. The balance was sold to Maurice Rothchild, one of the largest creditors, for $500,000. The sale has not been confirmed by the court as yet. A petition has been filed requesting that an investigation into the company's affairs be made first and that a new receiver be appointed. It is charged that the Security Trust Co. is both receiver and trustee for the bondholders, the majority of whom are Maurice Rothchild and J. B. Livingston, who petitioned for the receiver. This is the basis for the request that a new receiver be appointed.

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$50,000 Prize For Atlantic Flight

WASHINGTON, July 1—A prize of $50,000 to be awarded by the Government of the United States to the aviator or aviatrix who is first to fly across the Atlantic to England by any reasonable direct aerial route is proposed in a joint resolution introduced in the House yesterday by Representative Lunn of New York.

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Garabed Proves a Failure

WASHINGTON, July 1—"Garabed," the free energy invention of Garabed Giragossian, is a failure according to the report of the scientists appointed to investigate the machine. The committee appointed announces that it does not believe the principles of the inventor sound, or his devices practical, or that they could result in development of free energy.

Advises 8-Hour Day for Government

War Labor Policies Board Also Suggests Time and a Half for All Overtime

WASHINGTON, June 29—An 8-hour day wage rate, with overtime at the rate of time and one-half for all mechanics and laborers employed by the Government, was recommended by the War Labor Policies Board to-day. The board further recommended that mechanics and laborers employed upon construction work should be paid in the same way. It found, however, that while a uniform application of wage provisions as ordered by President Wilson in March on all Government work would tend to eliminate labor trouble, it would at the same time interfere with and hamper Government departments in securing supplies needed in the prosecution of the war. The board also decided that a conference should be held in the near future to determine to what extent during the period of the war the adoption of the basic 8-hour day principle of determining wages is feasible.

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Government May Take Aircraft Plants

WASHINGTON, July 1—The Senate Aircraft Investigating Committee, according to rumors here, will recommend that the Government take over all aircraft factories and run them under direct official supervision. Discoveries by the committee in some of the factories visited, it is said has brought the belief that in no other way can aircraft production be put on a basis which will enable it to catch up reasonably soon with the rest of the army. There are also rumors of profiteering by some of the concerns having aircraft contracts with the Government. The committee's report is expected to be made after Congress returns from the summer recess about Aug. 15.

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Cadillac Advances Prices

DETROIT, July 1—The Cadillac Motor Car Co. has advanced the prices of all its models, effective to-day. The old and new prices follow:

	New	Old
Open models	$3220	$2970
Brougham, 5 passenger	4090	3840
Victoria	3615	3365
Town limousine	4360	4160
Town landaulet	4510	4310
Landaulet	4490	4290
Limousine	4395	4195
Chassis (125 in.)	2690	2490
Chassis (132 in.)	2770	2570
Chassis (145 in.)	2810	2610

Two New Redden Units

CHICAGO, July 1.—The Redden Motor Truck Co. has enlarged its line by the addition of two new products, one a universal truck maker, which has been designed to fit any make or model of passenger car, regardless of the kind or location of the transmission mechanism, and a four-wheeled trailer.

To Use Motor Trucks Instead of Tubes

President Vetoes Pneumatic Conveyor Contracts for Postal Service in Large Cities

WASHINGTON, June 29 — President Wilson's vetoing of the annual Post Office Appropriation Bill on the ground that it provided for the continuing of the pneumatic mail tube systems in New York, Chicago, Boston, St. Louis and Philadelphia is a noteworthy endorsement of the motor truck, as the President's objections to the continued use of the mail tubes are based on the reports of experts who stated that the purpose of the tubes could be more satisfactorily accomplished by the use of surface motor transportation.

As a result of this action by the President, the mail tubes which connect the post offices and railroad terminals and the main offices with branch stations in the cities named will cease operation on July 1 unless arrangements are made in individual cases to continue their use temporarily while changes in the distribution system can be effected.

The new plan will call for a much extended use of motor trucks, and the number in the service of the Government in post office work will consequently have to be increased materially.

Provision was made in the vetoed measure for a sufficient number of motor trucks to take care of the additional burden which would be imposed upon surface transportation with the discontinuance of the use of the mail tubes, and this clause of course remained in the new bill eliminating the use of the tubes, which was immediately put through after the President had vetoed the original one.

In his veto message President Wilson said:

"At the time that they (the pneumatic tubes) were installed, they may have had some value as a postal facility, but that was before the volume of mail had reached the enormous proportions which it has to-day, and before the development of the use of motor vehicles. These developments have made the tubes practically obsolete, quite unnecessary, and, in fact, a hindrance to the efficient operation of the postal service. . . . The Post Office Department has found it necessary, because of the unreliability and the inefficiency of the tubes, to divert a large quantity of mail formerly dispatched by their use to autos, wherever close connections are required. It has been found that late closings of the mails can be accomplished, and a closer connection assured by this means. I am informed that this is true even in the congested sections of New York City.

"I am informed that during the last 10 years many efforts have been made to extend the present system of pneumatic tubes, but that these extensions have been invariably advised against by the departmental commissions of the postal experts, who investigated the matter, and that the reports of these experts invariably called attention to the development of the automobile as a factor which would have to be considered at the close of the present rental contracts."

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Manternach Heads American Welding

CLEVELAND, July 1—J. C. Manternach has been elected president and general manager of the American Welding & Mfg. Co., Warren, Ohio, which was formed early this year, with $200,000 capital. Other officers are: Vice-president and general superintendent, C. W. Gressle, up to June 1 last and for more than 20 years connected with the Standard Welding Co. and later the Standard Parts Co.; treasurer, Dan A. Gieger, president of the Western Reserve National Bank; secretary and counsel, F. D. Templeton; master mechanic, J. L. Greer, formerly of the Trumbull Steel Co.; foreman of base and band department, Charles G. Smith, who held a similar position with the Standard Welding Co. The first unit of the company's plant, consisting of a one-story brick and steel structure, 100 x 260, is nearing completion, and it is planned to have the plant in full operation by Sept. 1. The company will produce S. A. E. bands, bases for solid tires, gear and chuck ring blanks, bands and wheels for tractors and steel tires for government artillery and escort wagons. The initial capacity will be about 500 base bands and 1000 S. A. E. bands per day. This will be considerably increased. Mr. Manternach has been manager of the rim and tube division of the Standard Parts Co., Cleveland, which position he left July 1, after having served the company for 8 years.

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Production of Spruce and Douglas Fir

WASHINGTON, June 28—According to what are called "preliminary final figures" on 1917 lumber production, just issued by the Forest Service of the U. S. Department of Agriculture, the reported production of Douglas fir last year was 5,327,720 thousand feet. This was 96 per cent of the computed production. The reported production of spruce was 975,913 thousand feet, as against a computed production of 1,125,000 thousand feet. The reported production in this case was only 86 per cent of the computed.

Incidentally it may be mentioned that the total lumber cut for the country for 1917 was approximately 10 per cent less than the production in 1916. This is attributed principally to the largely decreased private building operations, the scarcity of labor in connection with small operations, transportation difficulties, curtailment of demand on the part of wood using industries, and a more or less general dislocation of lumber distribution through ordinary channels of trade. A considerable portion of the total quantity produced was utilized in meeting the exceptional demand for Government construction and other war emergency projects, including ship material.

Maximum Prices for Lumber Set

Government Price Fixing Committee Establishes Figures for Fir and Pine

WASHINGTON, D. C., June 28—Maximum prices for two classes of lumber, fir and yellow pine, have recently been determined by a price fixing committee appointed by the President. The establishment of maximum prices on fir is of considerable interest to the aircraft industry, inasmuch as it has recently been found that Douglas fir is a satisfactory substitute for spruce in the manufacture of aircraft.

The action of the price-fixing committee was taken after consultation with loggers and lumber manufacturers of the Pacific Northwest, and of the South respectively. The price of fir lumber for aircraft use is to remain the same as now in effect. The price of fir ship timbers to the Emergency Fleet Corporation is to remain the same as that determined upon by the price-fixing committee on March 18, 1918.

Prices of all other items of fir lumber are to be based on the West Coast price list of May 1, 1915, plus additions on certain items enumerated on a discount sheet issued on Feb. 15, 1918.

Prices Apply to All Mill Purchases

In an explanatory note accompanying the announcement of the new prices, by the Bureau of Public Information, it is stated that Douglas fir lumber prices apply on lumber manufactured in the Pacific Northwest, and represent an average increase of approximately $2.75 per thousand board feet over the former list of prices for Douglas fir sold to the Government. The prices as now established are f.o.b. mill and apply to all purchases of Douglas fir for mill shipment.

The yellow pine prices apply on lumber manufactured in the southern states enumerated in the ruling. These prices represent an average increase of approximately $4.80 per thousand board feet over the former Government list. The prices now established for yellow pine are likewise f.o.b. mill and apply to all purchases of yellow pine for mill shipment. Mill prices charged to the commercial trade for yellow pine prior to the date of the new ruling averaged considerably higher than the price fixed for Government purchases. This new ruling will not result in any higher prices than were formerly paid by the commercial trade for yellow pine, although it does mean a higher price for the Government. In the case of Douglas fir the new prices will result in a very slight, if any, average advance to the commercial trade.

—

Ford Tractor Increases Capital

Henry Ford & Son, Dearborn, Mich., have increased their capital stock from $1,000,000 to $5,000,000.

For Efficient Use of Freight Cars

Government Issues Regulations for Proper Loading of Cars and Routing

WASHINGTON, June 27—To utilize freight cars to the maximum the United States Railroad Administration has issued instructions as follows:

1. Consignments may be made for the same or for separate destinations. If for 2 or more destinations, intervening consignments must be to agency stations directly intermediate to the final destination.

2. Each consignment must be properly marked, showing consignee and destination, and loaded in manner best calculated to facilitate the unloading of each consignment with the least possibility of confusion, error, loss, or damage.

Bills of Lading and Waybills

3. Bills of lading and separate waybills must be made so as to distinguish each consignment as if loaded in a separate car. Waybills must plainly indicate that car contains 2 or more separate shipments and should be plainly indorsed "car contains more than one load, stop at ——— for partial unloading."

4. No diversion or change of destination or reconsigning in transit will be allowed, except where, under published rules, it may be in the same direction and over the same route as in the initial shipments after previous shipments have been unloaded. Movement to final destination will not be considered a reconsignment.

5. Switching or lighterage charges, if any, will be assessed for delivery at each destination, according to current switching tariffs. No switching or lighterage charge will be made against shipper or consignee for return of car to carrier at one destination for its continued journey beyond. The inbound carrier will absorb such charge, if any.

Agent to Supervise Unloading

6. Agent must supervise unloading and make careful check on quantity and condition of consignment for his station. He must see to it that load remaining in car is rearranged, if necessary, to protect it from damage. He must note on waybill that part of load, for his station, has been removed. He must see that car is promptly reported for movement to next destination.

7. When shipments are for the same destination, notice of arrival and demurrage will be handled as follows:

(A) Where two or more consignments take bulk track delivery all consignees will be promptly notified of arrival of car, that simultaneous unloading may be accomplished.

Payment of Demurrage

Consignees responsible for detaining car beyond free period must pay the demurrage charge. In the event that more than one consignee fails to remove contents within free period, demurrage will be collected pro rata.

(B) Where one consignee takes bulk track delivery and another private track delivery, each transaction will be independent of the other and demurrage will be charged accordingly.

8. Double or triple loading of consignments billed "shipper's order" will not be permitted unless the name and address of the party or firm to be notified are shown on the original shipping instructions and the location of such party or firm is at the billed destination of the consignment.

Type of track-laying artillery tractor which is being produced in France at the plant of the Schneider company

—

Cadillac to Continue Present Type

DETROIT, June 29.—The Cadillac Motor Car Co. will continue its present type of chassis and body styles this year.

—

Ryan's Office Moved

WASHINGTON, June 27.—The office of John D. Ryan, Director of Aircraft Production and chairman of the Aircraft Board, was moved from the Munsey Bldg. to Wing 8, second floor, Building "D," Fourth Street and Missouri Avenue, N. W.

The Aircraft Board has been assigned offices in the Fourth Street wing of the same building. The Bureau of Aircraft Production is now located in the Fourth Street end. The removal of the offices of the Director of Military Aeronautics to the Sixth Street or western end of Building "D" brings the two main branches of the Army Air Service under one roof.

The Washington office of the Aerial Mail Pilots and the Washington Aviation Examining Board are also now located in the Sixth Street end of this building. Offices have also been assigned to the British, French and Italian Aviation Missions in the same section of the building.

—

Parts Sent as Baggage

DETROIT, June 29.—Because of the inability to get all the required material from the east, much of which is sent by express, the Cadillac Motor Car Co. has found it advisable to send a number of men from its purchasing department to bring back the desired parts. These men obtain the parts and pack them into trunks and return with them, marking the trunks as baggage. Only small parts, such as hinges, door handles and accessories, can be carried in this way. The method is expensive, but was the only way the company could secure the needed parts.

All Australian Zinc For England

Great Britain Contracts for Entire Output of Concentrates —Nine-Year Period

WASHINGTON, June 27.—The Australian Government has contracted to sell to the British Government the whole output of zinc concentrates in Australia for the period of the war and 10 years thereafter. On his previous visit to London the Prime Minister contracted for the sale to the Imperial Government of 100,000 tons of zinc concentrates and 45,000 tons of electrolytic zinc and spelter for 10 years.

The new arrangement contemplates the British Government taking the stocks of zinc concentrates on hand Dec. 31, 1917, less a definite percentage reserve, and thereafter 250,000 tons per annum for the period of the war, and 300,000 tons annually for the 9 following years.

Provision is also made for supplying the requirements of the Australian zinc refining works and the fulfilling of Japanese contracts during the period covered by the British contract. It is also hoped to extend the contract to take in copper and lead. Under normal conditions the Australian output of zinc concentrates, averaging from 46 to 48 per cent zinc, is about 400,000 tons a year.

—

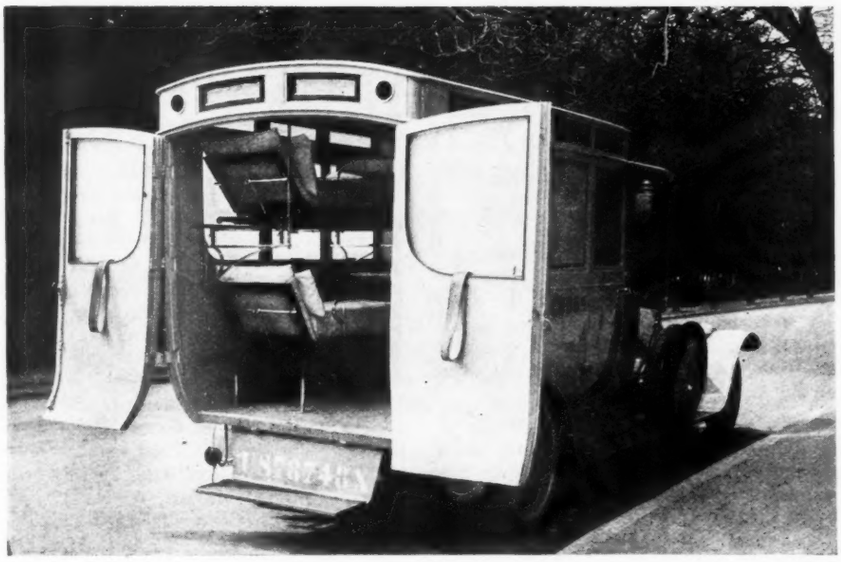
Hayes to Handle Fender Sales

DETROIT, June 29—The Hayes Mfg. Co. will handle the sale of the Hayes crown fenders for Ford cars and Hayes electric light bulb cases, which were formerly handled by the Onguard Auto Necessities Co., New York. The personnel of the Onguard company remains unchanged.

—

G. M. C. Moves Patent Department

DETROIT, June 26—The General Motors Corp. will move its patent department from Detroit to 1764 Broadway, New York City, about July 1.



View of the sleeping car for war uses developed by two American Red Cross officers. Note position of the berths

Design Sleeping Car For War

American Red Cross Officers Develop Two-Berth Machine on Renault Chassis

By W. F. BRADLEY

PARIS, June 8—One of the minor but at the same time serious problems to be faced by all military men in the zone of advance is that of sleeping accommodation. For several miles back of the lines towns and villages are so packed with troops that the most meager accommodation has to be accepted with gratitude. In France it is the custom for a special traffic regulating committee to make a census of all available accommodations in the zone through which troops will have to pass. Every house, every shed and every building is inspected, and a board attached to the walls showing how many officers, men and horses can be accommodated in each.

This means that when troops enter a town they know exactly how many of their number can be lodged in each and every building, and unless that number of troops is already in possession they have only to take up their quarters.

The automobile services, by reason of the fact that they are always on the move, are most interested in these general arrangements and are most frequently obliged to accept any makeshift quarters which may present themselves. Some truck drivers, knowing from experience that the quarters officially allotted to them may be anything but desirable, have made arrangements to transform their vehicles into bedrooms by the use of hammocks slung from the bows. Except in cold weather, fairly comfortable quarters are secured in this way.

Two American Red Cross officers, who have had sufficient experience with conditions in France to realize the precariousness of relying on sleeping accommodation in permanent buildings, have had designed a car which makes them independent of the billeting officers.

The vehicle, an illustration of which is published, is a 35-hp. Renault with a special sleeping car body built on it. Down the left-hand side are two berths, consisting of a frame with adjustable headrest and mattress. These berths are carried on rails and are spring-mounted with a view to comfort when the vehicle is in motion. The two berths can be pulled out like stretchers and the supports for the rails can be demounted in a few minutes, leaving the interior of the car absolutely free.

On the right-hand side is a wardrobe and washing apparatus. There is a spacious central alleyway leading into a forward compartment just behind the driver's seat. This front compartment forms an office or smoking room, and admission to it is by means of side doors.

The car is equipped with electric lighting and is mounted on Michelin detachable steel disk wheels, those at the rear being duals. This is one of the most comfortable and luxurious automobile sleeping cars in use on the front in France.

—

Michigan Divided Into 13 Districts for War Work

DETROIT, June 29.—The lower part of Michigan has been organized for general work under the direction of the War Industries Board. Thirteen districts of the regional industrial commission were named and leaders put in charge of the work in each division. These districts will work under the general supervision of Allan A. Templeton.

Every industry in the State of Michigan comes under the general direction of the commission, whose main duty will be to facilitate the production of war material under the general direction of the War Industries Board. One of the main objects of the commission will be to obtain war contracts for the companies able to handle them. As soon as information is obtained about companies which can take additional munition contracts the commission will endeavor to place contracts with them.

—

Copper Price May Be Increased

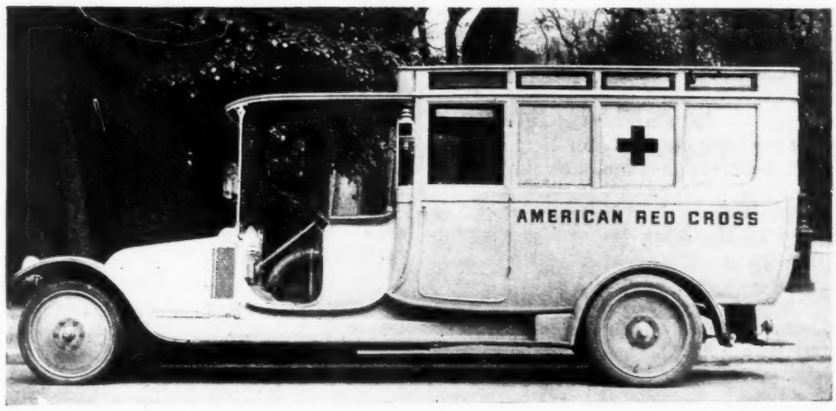
WASHINGTON, June 29—There is a strong feeling among copper producers that the War Industries Board, through its price-fixing committee, should increase the price of copper from 23½ cents a pound to 25 cents. The chief reason for asking for an increased price is that the new freight rate, it is estimated, will add a full cent to the cost of production.

The next conference between the Government and company representatives is to be held on Aug. 7 to consider the price, which will extend from Aug. 15. It is believed that before the former date a preliminary conference will be held either in New York or Washington.

—

Philadelphia Office for Edison Battery

PHILADELPHIA, June 29—The Edison Storage Battery Co., Orange, N. J., has opened a sales office here in the Land Title Bldg. J. A. Hurst, sales engineer of the company, is in charge.



External appearance of the Red Cross sleeping car which has been built on a Renault chassis

Sibley Joins Packard Co.'s Advertising Staff

Hi Sibley, formerly advertising manager of the Republic Motor Truck Co., Alma, Mich., has joined the advertising staff of the Packard Motor Car Co., Detroit.

—

R. J. Price, sales manager for the Highway Tractor Co., Indianapolis, has resigned to become zone manager in the southeast for the Heath-Duplex department of the McCord Mfg. Co., Detroit.

—

C. W. Zaughop, formerly eastern district manager of the Rainier Motor Truck Co., has joined the wholesale sales force of the Hurlburt Motor Truck Co., New York. He will cover Pennsylvania and Ohio territory.

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Louis W. Cossey has been appointed sales representative of the Lane Motor Truck Co., Kalamazoo, Mich., for western Massachusetts and New York. He was formerly in charge of the International Motor Company's Albany branch.

—

T. L. Loose, formerly with the Hendee Mfg. Co., Springfield, Mass., has been appointed manager of the Canton Spring & Axle plants of the Standard Parts Co., succeeding J. B. Childe. The latter will go to the general offices in Cleveland.

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F. F. Grimmelsman, formerly assistant manager of the Hess-Pontiac Co., has been appointed manager of the Perfection Spring plant of the Standard Parts Co., Cleveland.

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W. L. Woodward, formerly assistant manager of the rim and tube plant of the Standard Parts Co., Cleveland, has been promoted to the managership, succeeding J. C. Manternach, resigned.

—

Ralph A. D. Preston, who has been in charge of the flying field of the Goodyear Tire & Rubber Co., near Akron, Ohio, where instruction in balloon service is given to student officers of the army and navy, has received his commission as lieutenant, senior grade, in the United States Naval Reserve Flying Corps. He is stationed at Washington, where he is in charge of repairs on navy airships.

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William A. Scharon, formerly with the advertising departments of the Packard Motor Car Co. and the Timken-Detroit Axle Co., has been appointed advertising manager of the Hyatt Roller Bearing Co., tractor bearings division, Chicago.

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K. B. Howard has been appointed a director of the Stutz Motor Car Co., Indianapolis, to fill a vacancy on the board.

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D. Kiefer, engineer in charge of the ordnance division at the Harroun Motors Corp., Wayne, Mich., has resigned to join the navy.

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J. M. Dine, for the past 5 years manager of the Omaha branch of the Goodyear Tire & Rubber Co., has been appointed assistant manager of the Chicago branch of the company. C. A. Cramer, of Cedar Rapids, Ia., succeeds Mr. Dine as manager of the Omaha branch.

—

K. R. Jacoby, formerly assistant sales manager of Willys-Overland, Inc., has been promoted to the position of assistant to First Vice-President C. A. Earl.

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J. H. W. Mackie has been appointed sales manager of the Saxon Motor Car Co. He was appointed assistant sales manager in February.

—

G. M. Evans, formerly treasurer of the Menominee Motor Truck Co., Menominee, Mich., has received the commission of captain in the Ordnance Department.

—

C. J. Welch, for 5 years manager of the truck tire department of the United States Tire Co., New York, has been promoted to the position of assistant sales manager of the organization.

—

Theodore H. Harvey, general manager and assistant secretary of the Pelton Steel Co., Milwaukee, since its organization 3 years ago, has resigned to accept the position of general manager of the Ohio Steel Foundry Co., Springfield, Ohio, effective July 1. William H. Schuchardt, vice-president and secretary of the Pelton company, has assumed the duties of general manager and will devote his entire time to the concern.

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T. O. Kellogg, general manager of the Overland Wausau Co., Wausau, Wis., distributer of the Overland and Willys-Knight, has been transferred to the same position in the Overland Madison Co., Madison, Wis., distributer in the state capital territory, embracing all of southwestern Wisconsin.

—

Capital Increases

The K. & M. Brass & Aluminum Castings Co., Cleveland, has increased its capital from $10,000 to $100,000.

The American Twist Drill Co., Detroit, has increased its capital stock from $100,000 to $200,000.

The Detroit Gear & Machine Co., Detroit, has increased its capitalization from $500,000 to $700,000.

The Ferro Stamping & Mfg. Co., Detroit, has increased its capitalization from $25,000 to $40,000.

Men of the Industry

Changes in Personnel and Position

Hayes Plant Manager For Hess-Pontiac Axle

Lawrence Hayes has been appointed factory superintendent and assistant plant manager of the Hess-Pontiac Spring & Axle Co., Pontiac, Mich., having been transferred from the Perfection Spring division of the Standard Parts Co., Cleveland, where he was superintendent. Previous to this he was superintendent of the Cincinnati & Hammond Spring Co., Cincinnati, and D. W. Shuler & Sons, Amsterdam, N. Y.

—

George H. Bishop, for sixteen years connected with the Eclipse works of Fairbanks, Morse & Co. at Beloit, Wis., to-day resigned to accept charge of the general organization and system work of the Wright-Martin Aircraft Corp., with works at New Brunswick, N. J.; Long Island City, N. Y., and other eastern cities.

—

Howard Cody, for the past several years sales manager for the Frank O. Renstrom Co., San Francisco, Premier, Grant, Bethlehem and Atterbury distributer has been placed in charge of wholesale sales. He is succeeded by E. W. Papert.

—

H. G. Wedler of the Emil Grossman Mfg. Co., Brooklyn, has joined the colors and is in the mechanical repair shops, Unit 305, Camp Jesup, Atlanta, Ga.

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Record Pennsylvania Registration

PHILADELPHIA, June 29—It is expected that fully 350,000 Pennsylvania license tags will be used this year, as the department at Harrisburg is issuing No. 325,000. The order for 1919 will be the biggest ever issued—for 400,000, to be of black enamel with numbers in red and a space for the manufacturer's number. They will be similar in general style to those now in use.

—

Ohio Has 380,000 Cars

COLUMBUS, O., July 1—The Ohio Automobile Department up to July 1 has issued approximately 380,000 registrations for gasoline cars in Ohio as compared with 347,542 registrations for the whole of 1917. Electrics were registered up to July 1 to the number of 4400 as compared with 4510 during last year, and dealers and manufacturers to the number of 32,000 were registered to the middle of the year compared with 34,078 for last year.

—

Truck Converter from Loganville

MILWAUKEE, July 1—Leicher Bros., Loganville, near Prairie du Sac, Wis., have undertaken the manufacture of a new type of truck chassis for application to used passenger cars and plan a large production. The Leicher shops are being enlarged and considerable new equipment installed to handle the growing business, which comes from all sections of Wisconsin and eastern Minnesota.

AUTOMOTIVE MATERIALS MARKETS

Material Market Prices

Acids:
Muriatic, lb. ..... .02-.03
Phosphoric, ct. ... .35-.39
Sulphuric (60), lb.. .11

Aluminum:
Ingot, lb. ..... .33
Sheets (18 gage or more), lb. ..... .40

Antimony, lb. ..... .13

Burlap:
8 oz. yd. ..... .19
10 oz. yd. ..... .23¼-.23½

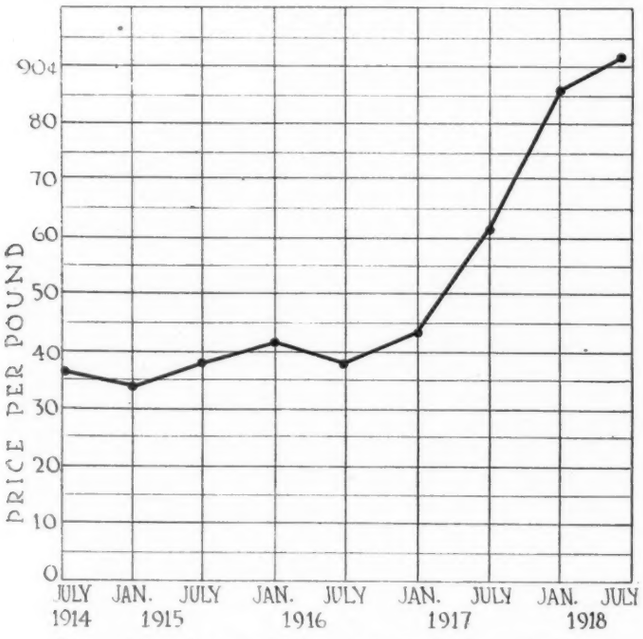
Copper:
Elec, lb. ..... .23½
Lake, lb. ..... .23½

Fabric, Tire (17¼ oz.):
Sea Is., combed, lb. 1.65-1.70
Egypt, combed, lb.. 1.20-1.30
Egypt., carded, lb... 1.15-1.25
Peelers, combed, lb. 1.05-1.20
Peelers, carded, lb. .95-1.05

Fibre (⅛ in. sheet base), lb. ..... .45

Graphite:
Ceylon, lb. ..... .07½-.25
Madagascar, lb. ... .10 -.15
Mexican, lb. ..... .03½

Lead, lb. ..... .07¾-.08⅛



How the price of tin has increased since the war began. The points on the curve are the monthly averages of daily New York quotations

Leather:
Hides, lb. ..... .18-.33

Mica:
India:
Grade 4, lb. 3.00
Grade 5, lb. 1.50
Amber:
Grade 4, lb. 1.25
Grade 5, lb. ..... .65

Nickel, lb. ..... .40

Oil:
Gasoline:
Auto., gal. ..... .24
68 to 70 gal. ..... .30
Lard:
Prime City, gal. .2.20
Ex. No. 1, gal. ..1.45
Linseed, gal. 1.65
Menhaden, gal. 1.05
Petroleum (crude):
Kansas, bbl. 2.25
Pennsylvania, bbl. 4.00

Rubber:
Ceylon:
First latex pale crepe, lb. ..... .63
Brown, crepe, thin, clear, lb. ..... .60
Smoked, ribbed sheets, lb. ..... .62
Para:
Up River, fine, lb. .68
Up River, coarse, lb. ..... .40
Island, fine, lb... .59
Island, coarse, lb. .27
Caucho, ball, upper, lb. ..... .40
Caucho ball, lower, lb. ..... .36

Shellac (orange), gal. .65-.70

Soda, caustic, lb. .... .04

Solder:
Half and half, lb... .70
No. 1, lb. ..... .63
Refined, lb. ..... .51

Spelter ..... .04½

Steel:
Angle beams and channels, lb. ..... .03
Automobile sheet (see sp. table).
Cold rolled, lb. ..... .06½
Hot rolled, lb. ..... .03½

Tin ..... .94-.95
Waste (cotton), lb... .12¾-.17

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only. Per 100 lb.	Primes when seconds up to 15 per cent are taken. Per 100 lb.	Seconds arising.
Automobile body stock	$5.95	$5.85	*See Note
Automobile body stock, deep stamping	6.20	6.10	
Automobile body stock, extra deep stamping	6.45	6.35	
Hood, flat fender, door and apron, or splash guard stock	6.05	5.95	
Crown fender, cowl and radiator casing, deep stamping	6.30	6.20	
Crown fender, cowl and radiator casing, extra deep stamping	6 55	6.45	

Automobile Sheet Extras for Extreme Widths:
Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lb.
Nos. 19 to 21 over 36 in. to 44 in., 30c. per 100 lb.
Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lb.
Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lb.
Black sheet extras to apply on narrow widths.
Oiling, 10c. per 100 lb.
Patent leveling, 25c. per 100 lb.
Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.

*Ten per cent less than the invoice Pittsburgh price for corresponding primes.

Automotive Securities Quotations on the New York Exchange

	Bid	Asked	Net Ch'ge
*Ajax Rubber Co.	87¼	87½	+2½
*J. I. Case T. M. Co., pfd.	80	86	..
Chalmers Motor Co., com.	4	6	..
Chalmers Motor Co., pfd.	25	35	+5
*Chandler Motor Co.	81	82	+2
Chevrolet Motor Co.	138	142	+10
*Fisher Body Corp., com.	38½	40	—1
*Fisher Body Corp., pfd.	86	89	..
Fisk Rubber Co., com.	55	58	+1
Fisk Rubber Co., 1st pfd.	98	102	..
Fisk Rubber Co., 2nd pfd.	78	103	+19
Firestone Tire & Rubber Co., com.	89	91	..
Firestone Tire & Rubber Co., pfd.	93	95	..
*General Motors Co., com.	152¾	155	+14
*General Motors Co., pfd.	81⅞	82	..
*B. F. Goodrich Co., com.	45	46	+ ½
*B. F. Goodrich Co., pfd.	98	99	+ ¾
Goodyear Tire & Rubber Co., com.	167	170	+10
Goodyear Tire & Rubber Co., pfd.	97	99	..
Grant Motor Car Corp.	2½	3½	+ ½
Hupp Motor Car Corp, com.	2¾	3	..
Hupp Motor Car Corp, pfd.	78	81	—4
International Motor Co., com.	29	35	..
International Motor Co., 1st pfd.	55	65	+3
International Motor Co., 2nd pfd.	35	40	—3
*Kelly-Springfield Tire Co., com.	50	51	+ ½
*Kelly-Springfield Tire Co., 1st pfd.	81	87	..

	Bid	Asked	Net Ch'ge
*Lee Rubber & Tire Corp.	19	20	+1
*Maxwell Motor Co., Inc., com.	27¾	28¼	..
*Maxwell Motor Co., Inc., 1st pfd.	55	..	..
*Maxwell Motor Co., Inc., 2nd pfd.	19	21	..
Miller Rubber Co., com.	99	101	..
Miller Rubber Co., pfd.	90	92	..
Packard Motor Car Co., com.	112	120	+4
Packard Motor Car Co., pfd.	93	..	..
Paige-Detroit Motor Car Co.	18	20	+3
Peerless Truck & Motor Corp.	14	16	—1
Portage Rubber Co., com.	100	102	..
†Reo Motor Car Co.	13	15	..
*Saxon Motor Car Corp.	8¼	8½	— ½
Standard Motor Construction Co.	12	14	+1¼
*Stewart-Warner Speed. Corp.	57½	58½	..
*Studebaker Corp., com.	46	46½	+1
*Studebaker Corp., pfd.	80	90	..
Swinehart Tire & Rubber Co.	50	65	..
United Motors Corp.	34	35	+4½
*U. S. Rubber Co., com.	58¾	59	+ ¼
*U. S. Rubber Co., pfd.	103	105	+1¼
White Motor Co.	41	42	— ½
*Willys-Overland Co., com.	20	20½	— ⅛
*Willys-Overland Co., pfd.	81	83	..

*At close June 29. Listed N. Y. Stock Exchange. †Par value $10.

Government to Train Women Health Officers

WASHINGTON, June 29 — Women health officers, whose duty will be to see that the thousands of women workers in munitions plants are kept healthy and their output of war materials thus maintained at the peak of production, are to be trained under the direction of the Women's Division of the Industrial Service Section of the Army Ordnance Department.

An eight weeks' course of study for a limited number of carefully selected women health officers started to-day at Mount Holyoke College, South Hadley, Mass. The course will be given under the general direction of Dr. Kristine Mann, Health Supervisor of the Women's Branch of the Ordnance Department. The women who are to take the course are college graduates, or women of equivalent technical education. Almost all have had experience in dealing with working women. The first requirement for admission to the course has been perfect health, and only those have been selected who will inspire wholesome living among the munitions workers.

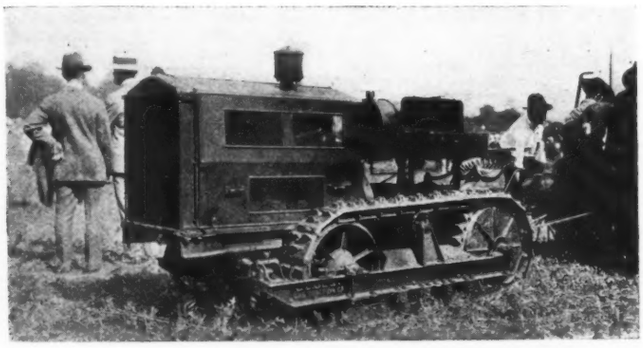
G. M. C. Trucks for Medical Corps

WASHINGTON, June 29 — One and one-half-ton G. M. C. trucks equipped with special bodies made by the H. M. Babcock Co. will be used by the Medical Corps of the United States Army for mobile X-ray equipment. Each truck will carry a complete X-ray outfit with a specially designed collapsible X-ray table. A stationary gas engine is included in the equipment and generates the electrical power for the X-ray. The sides of the truck body can be converted into tables, on which the patients can be treated. A demonstration of this truck and X-ray table was successfully made here before several medical officers.

Find Brisk Demand for All Closed Car Types

TOLEDO, June 27—The demand for closed cars is greater than at any previous time, according to the Willys-Overland, Inc., and the proportion of closed car sales as compared with sales of open models shows a remarkable increase. More Willys-Overland closed cars have been sold since Jan. 1 this year than the total sales of all closed cars, excepting only the coupe types, in all the previous years the company has been in business. At the present time three models of closed cars are available for delivery: Overland Model 90 sedan and model 85-six coupe; Willys-Knight model 88-four coupe. Production plans for the balance of this year also provide for other models. These include the Willys-Knight model 88-four sedan and limousine, and the model 88-eight sedan, limousine and coupe.

The Tractor Demonstration at the S. A. E. Meeting in Dayton



During the S. A. E. summer meeting there was quite a demonstration of farm tractors, the Fordson, Best, Cleveland, Case and Parrett being put through their paces for the benefit of the visiting engineers. Below is the Parrett and above is the Best; the others are easily recognizable

Premier Rubber To Make Insulation Material Line

DAYTON, OHIO, June 29—The Premier Rubber & Insulation Co. has been organized for the manufacture of rubber insulation used for airplane and automobile parts. A plant has been erected here and is already in operation. The company was founded by A. Huetter, for many years superintendent of the Boonton Rubber Mfg. Co., Boonton, N. J., and who is now vice-president and general manager of the Premier organization.

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Buckeye Brass Adds to Plant

CLEVELAND, June 26—The Buckeye Brass & Mfg. Co. has purchased the plant and part of the tool equipment of the Cleveland Pneumatic Tool Co. The former company was organized 8 years ago and has outgrown its present plant.

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Smith & Hemenway Adds

IRVINGTON, N. J., June 29—The Smith & Hemenway Co., Inc., is erecting an addition to its plant. This will be used for the manufacture of Red Devil tools ordered by the Government.

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Anderson Has New Building

DETROIT, June 27—The Anderson Electric Car Co. announces the completion of its new building, 300 by 150, which is to be used for the assembling of ambulances for the Government.

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Combine Boston Maxwell and Chalmers

BOSTON, June 30—One of the biggest deals in combining two forces was announced to-day when the C. E. Fay Co. that handles the Maxwell line joined with the Chalmers Motors Co. of New England. The plan had been under contemplation for some time. Mr. Fay heads the company as president, Francis P. Allen, manager of the Chalmers, is vice-president, and Allan M. Fay, a son of the president, is treasurer.

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Donovan Enters Truck Business

BOSTON, MASS., June 30—Joseph S. Donovan, who conducts the Studebaker agency in Boston and vicinity, has entered the truck business, too. He has taken on the Sanford line for eatsern Massachusetts. Frank E. Wing, who has handled the Marmon for many years exclusively, has been considering adding a truck line to his business, and has had conferences with a couple of well known makers.

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Dividends Declared

The Curtiss Aeroplane & Motor Corp. has declared a regular semi-annual dividend of 3½ per cent on preferred stock, payable July 15 to holders of record July 2.

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A quarterly dividend of 1¾ per cent on the preferred stock of the Mason Tire & Rubber Co., Kent, Ohio, has been declared, payable July 1 to stockholders of record at close of business June 15.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

Recent Incorporations

MILWAUKEE, WIS.—Acme Motor Parts Corporation; capital stock, $25,000; to manufacture and deal in motor car, truck and tractor parts and accessories; incorporators, William S. Smulski, Joseph Mietus and William P. Doucette.

MILWAUKEE, WIS.—North Milwaukee Chemical Works; capital stock, $30,000; to manufacture and refine chemicals, etc.; incorporators, John Hauser, Charles A. Schulz and Joseph M. Thomas.

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Baltimore Branch for Moline

BALTIMORE, July 1—The Moline (Ill.) Plow & Tractor Co. has opened a branch house in Baltimore to take care of the business on the Atlantic coast territory. The branch house has been organized and incorporated under the name of the Eastern Moline Plow & Tractor Co., the same as the branch at Bloomington, Ill.

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Corcoran to Increase Capacity

CINCINNATI, June 27—The Corcoran Mfg. Co. has purchased the former plant of the Knabe Piano Co. and will now be enabled to largely increase its production of radiators.

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Will Market K. A. L. Products

GRAND RAPIDS, June 28—The Furniture City Laboratories was recently organized for the purpose of manufacturing and marketing K. A. L. products throughout this territory. The line which they will produce includes body polishes for automobiles, hood and fender dressing, carbon remover and oil and greases. John F. Healy is manager of the company.

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Harroun Shipping Shells

WAYNE, MICH., June 28—The first unit of the shell department of the Harroun Motors Corp. is in operation, giving employment to about 300 people. There will be three more units in operation as fast as the machinery can be installed. The daily car production of nearly 200 per week is being maintained.

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Another Ford Plant for War

LOUISVILLE, July 1—The Louisville assembly plant of the Ford Motor Co. will be taken over by the Government for war work next month. Manager C. S. Williams said that the factory will cease assembling cars to-day and will prepare to turn over the place to any department of the Government which calls for it.

Olds Motor Works Will Produce Own Engines

LANSING, June 27—The Olds Motor Works is erecting a new building for the manufacture of engines for its car, which heretofore have been supplied by the Northway Motor Co., Detroit, one of the divisions of the General Motors Corp. The new building, which will be 500 by 240, and loading dock, 700 by 60, will cost $600,000, and an additional $500,000 will be spent in equipping it. Contract calls for completion of the new plant by Nov. 1, and operations will be started about Jan. 1, when from 1500 to 2000 additional employees, both men and women, will be placed on the pay roll. Plans call for separate locker rooms for each sex and rest rooms for the women. There will also be a convention lunch room where department heads may gather for meals.

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Bloomington Shops Organize

BLOOMINGTON, ILL., July 1—A strike of mechanics and helpers of Bloomington garages and repairshops was adjusted after the men had been out a week. The terms of the settlement fix 9 hours as a working day, overtime to be paid for at the rate of time and a half, including Sundays and all holidays.

Apprentices are subject to the same shop rules as mechanics. They must be between the ages of 16 and 21 and serve 4 years of 290 days per year before qualifying as mechanics. All competent mechanics with 4 or more years of actual repairshop experience will receive 55 cents per hour. Apprentices will receive 20 cents per hour and an increase of 2 cents per hour for every 6 months until 4 years have been served. Shop helpers will receive a minimum of 35 cents per hour. Floor men, washers and night men were given a 10 per cent increase in pay.

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Feltes Treasurer of Studebaker

SOUTH BEND, IND., July 1.—N. R. Feltes has been elected treasurer of the Studebaker Corp., succeeding Charles C. Hanch, who has been placed in charge of the Automotive Products Section of the War Industries Board. Mr. Feltes has served 8 years as assistant treasurer of the U. S. Rubber Co., one year as treasurer of the Lozier Motor Co. and for the past 4 years has been vice-president and general manager of the Ames-Holden-McCready, Ltd., Montreal.

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F. T. C. Finds Huge Profits

(*Continued from page* 33)

refineries operated for the sake of the gasoline almost exclusively, and fuel oil was commonly sold at a loss, but now fuel oil is a very profitable product.

"The foregoing table will show the percentage of net earnings on investment for a series of years. The earnings for 1918 are estimated on the basis of the second six months of 1917 or the first quarter of 1918."

Credits America With Tank Idea

NEW YORK, June 29—Major General E. D. Swinton of the British Army, in an address delivered at the Astor Theater for the benefit of the United States Tank Corps, said that the basic idea from which the British tanks were evolved was derived from American agricultural tractors of the creeper type.

The greatest secrecy was maintained in building the first lot of the machines. Even the name given to them was intentionally misleading. "They were called Tanks," said General Swinton, "so that not even the working men who were making them would know what they were manufacturing, and the rumor was circulated among the men that they were to be used in connection with the watering of our men in Egypt.

"Later, when it was time to punch holes in their sides for the guns, another story had to be invented. It was then rumored that they were snow ploughs to be used in Russia, and to carry out this deception each tank was stencilled with a Petrograd address, and when the tanks were finally shipped it was generally believed that they were going to Petrograd.

"In the final days of the construction of the tanks, 700 sentries, in three cordons, were thrown around the field in which the tanks stood. Matters were so arranged that the sentries of the outside cordon were not even aware of what was going on inside. It was shortly before the first of the tanks was shipped to France, in September, 1915, that a Zeppelin hovered over the tanks one night. The Zepp, however, came accidentally, and as they did not throw a searchlight to the earth the secret was never discovered."

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Housing Provisions Determined

WASHINGTON, June 29—All houses constructed for war workers by the Government will remain under the control of the United States until after the war. In so far as possible, all housing accommodations will be of a permanent character excepting where they are constructed in communities not likely to continue after the war. Loans will be advanced for the erection of dormitories to responsible corporations and associations not organized for profit. These arrangements for housing war workers have just been approved by Secretary of Labor Wilson and Director of Industrial Housing and Transportation Otto M. Eidlitz.

A management division is to be organized, which will undertake the management of government erected properties, and a division of existent housing will deal with the question of utilizing housing and boarding facilities of each community to reduce government housing to the lowest possible minimum.

In fixing the rentals for government constructed houses the following factors will have to be taken into account:

1. Fixed Charges.
   Interest on investment.
   Insurance.
2. Reserves for upkeep of rented houses.
   Repairs.
   Renovating and redecorating.
3. Reserve for loss in case of non-occupancy.
4. Overhead expenses of administration.
5. Depreciation.

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To Reconstruct Belgian Industry

PARIS, FRANCE, June 29—An organization has been started to help reconstruct Belgian industry and trade by furnishing tools and necessary raw materials for every possible industry. This society, which is called "Comptoir National pour la Reprise de l'Activite Economique en Belgique," and which is working with the co-operation and under the control of the Belgian government, is endeavoring not only to reconstruct the industries, but also to help the people of Belgium by enabling them to work in the reconstructed shops. The organization is appealing to American manufacturers of materials for the construction of buildings, leathers, textiles, farm implements, chemical products, wood machines, electrical materials, motor cars, trucks, oils and greases, for catalogs and price lists to facilitate it in the placing of orders.

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Canadian Settlers May Import Vehicles

OTTAWA, CANADA, June 29—Machines for agricultural purposes, and vehicles and implements moved by mechanical power may be imported free of duty by a settler, provided he has owned it 6 months before his removal to Canada. The machine, however, may not be sold or disposed of without payment of duty before it has been in actual use in Canada for 12 months.

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Grace Motors Takes on Sterling for Canada

MILWAUKEE, June 29—The Grace Motors, Ltd., with headquarters in Toronto, and branches in several Canadian cities, has been appointed Canadian distributer of the Sterling truck.

No Quad Royalties

KENOSHA, WIS., June 29—There has been much speculation concerning the manufacturing arrangements of the Nash Quad for military purposes, by which several organizations, namely, Hudson, Paige and National, are each building 2000 Quads for military use. C. W. Nash, president of the Nash Motors Co., has given to the United States Government the right to build the Nash Quad without royalty in any factories and in any quantities necessary for the period of the war. In addition to this the Nash company has furnished, free of cost, to different concerns manufacturing the Quads, the necessary working blue prints and is furnishing all the information by way of revisions to these blue prints without cost. G. W. Smith, who has been connected with the Nash engineering department, is giving all of his time assisting these companies in the manufacture of the Quads. It is expected that all three companies will be in production by July and the 2000 trucks from each should be completed soon after the first of the year.

Several outside concerns are assisting in the manufacture of parts for these trucks. Axles are being manufactured by Timken, Columbia and Salisbury. Transmissions are being manufactured by the Brown-Lipe and Haynes companies. Engines are being manufactured by Buda and Haynes. The M & S type of differential is being manufactured by Brown-Lipe-Chapin and M & S Corp. Lavigne is manufacturing the steering gears.

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Offer Night Photography Invention

WASHINGTON, June 29—An Italian invention permitting photography by night has been submitted to the Department on Military Aeronautics of the Army. It is claimed that excellent pictures can be taken of enemy positions from airplanes, lying at low heights on moonlight nights, and that the invention can be fitted to moving picture cameras, permitting photography of actual fighting much of which takes place in the early morning hours.

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Fafnir Starts a Dragon

NEW BRITAIN, CONN., June 30—The Fafnir Bearing Co. has issued a house organ which is called "The Dragon." It is devoted to affairs of the Fafnir manufacturing organization, its buying clientele, and information relating to the products.

Calendar

RACING

July 4—Cincinnati, Cincinnati Speedway.
July 4—Tacoma, Wash. Tacoma Speedway Assn.
July 27 — Chicago. Chicago Speedway.
Aug. 3—Uniontown. Uniontown Speedway Assn.
Aug. 10—Providence, R. I.
Aug. 17—Sheepshead Bay.
Sept. 2—Uniontown. Uniontown Speedway Assn.
Sept. 7 — Chicago. Chicago Speedway.
Sept. 21—Sheepshead Bay.
Oct. 5 — Cincinnati. Cincinnati Speedway.

SHOWS

July 29-Aug. 4—Salina, Kan. National Tractor Demonstration. Auspices of National Implement and Vehicle Assn.
Sept. 23-28—Chicago, National Accessory Show for Fords. Coliseum.
Oct. 14-27—Dallas, Tex. Seventh Annual Texas Automobile Show. Texas State Fair.

ENGINEERING

Sept. 2—Cripple Creek, Colo. American Institute of Mining Engineers.
Nov. 14-15—New York. Society of Naval Architects and Marine Engineers. Twenty-sixth general meeting. Engineering Societies Bldg., 29 West 39th Street.